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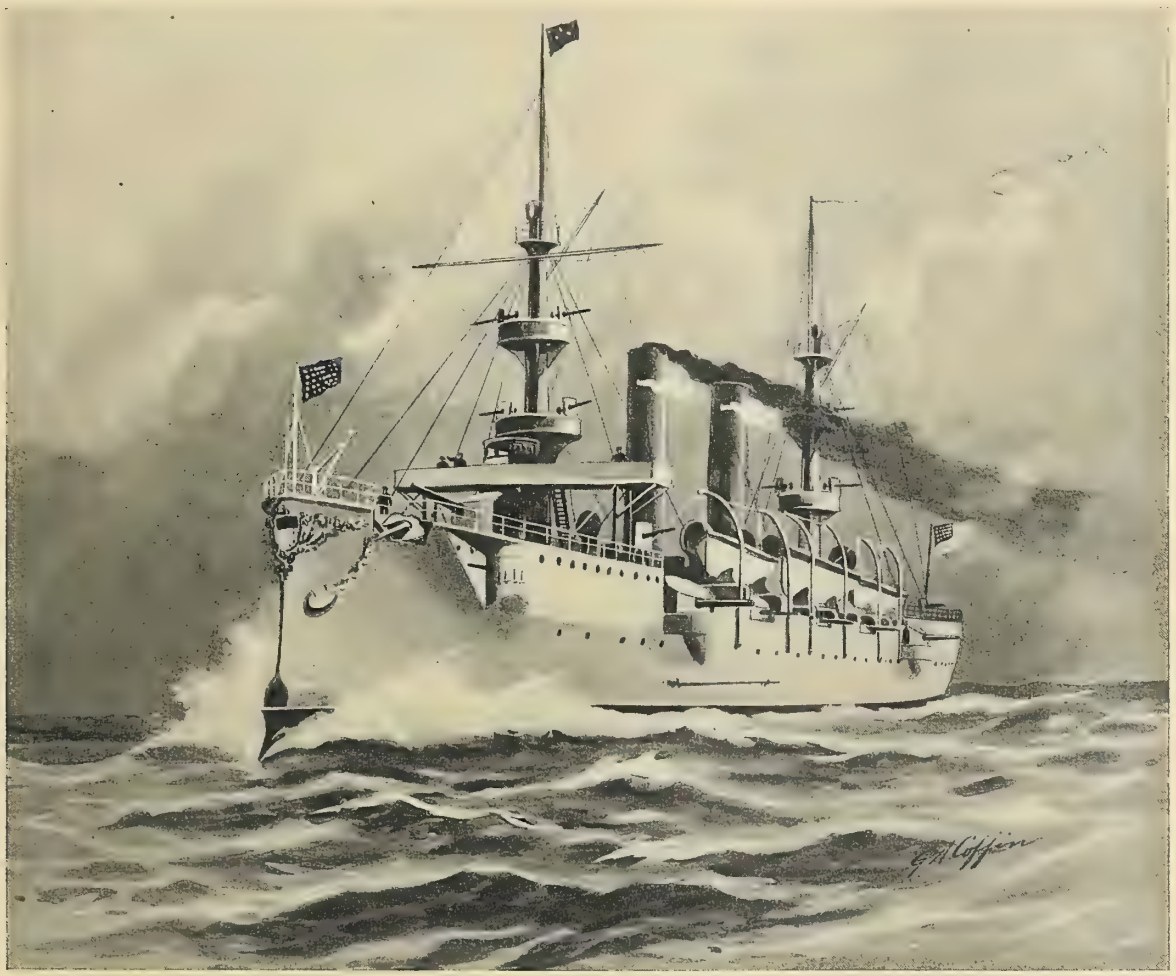
## PURCHASE OF THE BRAZILIAN CRUISERS AMAZONAS AND ABROUILL BY U. S.

During the past month there have been added to our navy two vessels, the "Amazonas" and the "Abrouill," built abroad for the Brazilian Navy. The "Abrouill" has appeared in print under about a half dozen different aliases, among them the "Admiral Breu." Among so many it is difficult to choose, but "Abrouill" seems to have the support of the best authority.

These two are the second and third respectively of three ships built by Sir W. G. Armstrong, Whitworth & Company at their Elswick yard, Newcastle-on-Tyne. The first of the three, the "Barroso," was launched on Tuesday, August 25, 1896, and completed her trials April 30, 1897. The "Amazonas," the second sister, was launched on Friday, December 4, 1896. The three ships are built of steel, sheathed with teak, and coppered. The "Amazonas" and the "Abrouill" will, therefore, be the first sheathed ships in our navy.



U.S. PROTECTED CRUISER NEW ORLEANS LATELY BRAZILIAN CRUISER AMAZONAS.

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The "Wheeling," the "Marietta," and other small gun boats, however, are composite and coppered. The dimensions of the "Amazonas" are as follows: Length, 330 ft.; beam, 43 ft. 9 in.; mean draught, 16 ft. 10 in.; disp., 3,450 tons.

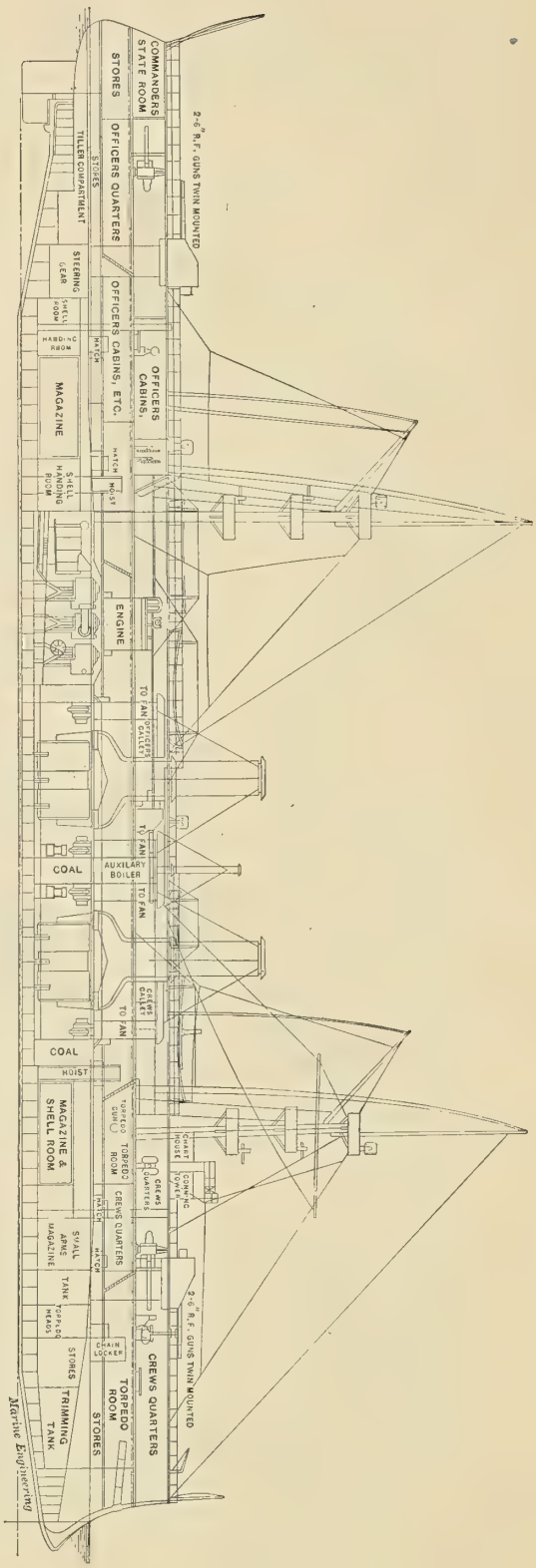
The "Amazonas" comes under the class of protected cruisers. Her only armor is 4 1-2 in. of steel on the gun positions, and a curved steel protected deck extending over her whole length about the water line. The deck is 1 1-4 in. thick on the flat, and 2 1-2 in. thick on the slopes. There is the usual coal protection, her side bunkers covering and enclosing the vitals and extending to 6 ft. above the water line. Experiments show 1 ft. of coal to be about equal to 1 in. of wrought iron armor, or 1-2 in. of the present steel armor.

The armament of the "Amazonas" consists of six 6-in. and four 4.7-in. Armstrong quick-firers, ten 6-pounders and four 1-pounder Nordenfeldts, four Maxims, two field guns and three torpedo tubes. She is able to concentrate a remarkably large proportion of her battery in any given direction. Two of the 6-in. guns are mounted as bow chasers and two as stern chasers. The other two are in the waist, one in each broadside. Each pair of chasers is mounted as twins, so that the two guns train together. Each pair has an arc of fire of 270°, 135° on each side of the fore and aft line. The 6-in. broadside guns can fire from dead-ahead to dead-astern. By this means the "Amazonas" can fire five of her 6-in. guns on either broadside, and four ahead or astern. In addition three of the 4.7-in. guns can fire on each broadside.

With reference to the armament of the "Amazonas" and the "Abrouill," the table on page 3 on Elswick ordnance was issued by the manufacturers last year.

No metallic cartridge is used with the 8-in. quick-fire guns of this table. The makers claim for the 1-pounders of the "Amazonas" and "Abrouill" a muzzle velocity of 2,300 ft. per second, making them superior even to that type of gun of the comparative table. The guns of both cruisers are in all respects the best modern type and highly efficient.

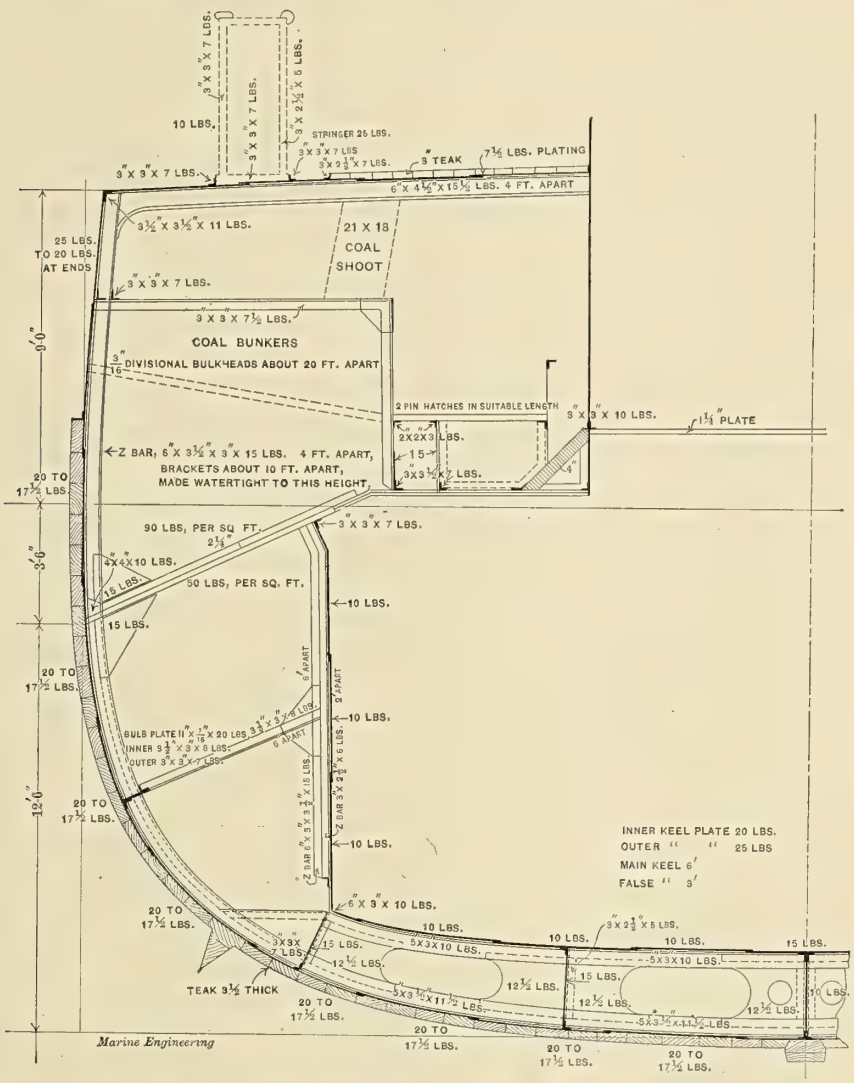
The 4.7 in. is a new caliber to our navy, and up to the time of the purchase of these vessels the navy had no ammunition of that caliber. According to the offer made to the Navy Department by the makers, both cruisers when delivered, were to have on board a full supply of all necessaries, except provisions and consumable stores. The articles thus to be furnished by the contractors include torpedo tubes, torpedo gear, and a full supply of ammunition except torpedoes. Besides, it is expected that more ammunition for the 4.7-in. guns will be bought abroad, and it is also understood that an American firm has agreed to furnish it. Should it after all be found impossible to supply the 4.7-in. guns with ammunition, they will be removed and replaced by the regular navy 5-in. rapid-fire guns, of which there are on hand




LONGITUDINAL SECTION OF THE U.S. TWIN-SCREW WOOD-SHEATHED STEEL PROTECTED CRUISER NEW ORLEANS.

COMPARATIVE TABLE OF ELSWICK RAPID-FIRE GUNS.

| Type of Gun. | Maxim-Nordenfeldt. | Maxim-Nordenfeldt. | Field and Naval. | Elswick Quick-Fire. | Elswick Quick-Fire. | Elswick Quick-Fire. | Elswick Quick-Fire. |
|---|---|---|---|---|---|---|---|
| Bore | 1.46 in. | 2.2 in. | 3 in. | 3 in. | 4.7 in. | 6 in. | 8 in. |
| Length of bore (calibers) | 29.9 | 42.3 | 28 | 40 | 48.9 | 50 | 44.6 |
| Length of gun (calibers) | .... | .... | 29.2 | 42 | 50 | 51.4 | 46.3 |
| Weight of gun | 458 lb. | 700 lb. | 7.5 cwt. | 12 cwt. | 55 cwt. | 7.6 tons | 19.9 t ns |
| Weight of projectile | 1 lb. | 6 lb. | 12.5 lb. | 12.5 lb. | 45 lb. | 100 lb. | 210 lb. |
| Weight of charge | 1 oz , 96 gr. | 12.5 oz. | 13.5 oz. | 1.62 lb. | 8.4 lb. | 19 5 lb. | 46 lb. |
| Muzzle velocity (feet per second) | 1,800 | 2,300 | 1,585 | 2,200 | 2,630 | 2,612 | 2,650 |
| Velocity at 2,500 yards (feet per second) | 600 | 1,060 | 904 | 1,084 | 1,564 | 1,506 | 1,918 |
| Muzzle energy | 22.5 ft. tons | 220 ft. tons | 217.8 ft. tons | 419.5 ft. tons | 2,158 ft. tons | 4,840 ft. tons | 10,226 ft. tons |
| Energy at 2,500 yards | .... | 46.7 ft. tons | 70.8 ft. tons | 102 ft. tons | 763 ft. tons | 2,262 ft. tons | 5,357 ft. tons |
| Penetration at muzzle | 2.2 in. | 7.2 in. | 4.9 in. | 8.1 in. | 15.7 in. | 21.2 in. | 26.1 in. |
| Rounds per minute | 250 | 28 | 20 | 20 | 10 | 7 | 4 |


3" X 3" X 7 LBS.
10 LBS.
STRINGER 25 LBS.
3" TEAK
7½ LBS. PLATING
6" X 4½" X 15½ LBS. 4 FT. APART
21 X 18 COAL SHOOT
25 LBS. TO 20 LBS. AT ENDS
COAL BUNKERS
DIVISIONAL BULKHEADS ABOUT 20 FT. APART
2 PIN HATCHES IN SUITABLE LENGTH
3" X 3" X 10 LBS.
1¼" PLATE
Z BAR, 6" X 3½" X 3" X 15 LBS. 4 FT. APART, BRACKETS ABOUT 10 FT. APART, MADE WATERTIGHT TO THIS HEIGHT
20 TO 17½ LBS.
90 LBS, PER SQ FT.
50 LBS, PER SQ. FT.
15 LBS.
INNER KEEL PLATE 20 LBS.
OUTER " " 25 LBS
MAIN KEEL 6'
FALSE " 3'
TEAK 3½ THICK
Marine Engineering

HALF CROSS-SECTION OF U.S. WOOD-SHEATHED STEEL PROTECTED CRUISER NEW ORLEANS.

numerous complete guns, provided for the auxiliary fleet.

It is believed that the American 6-in. projectiles, which are of ordinary use in our service, will fit the 6-in. guns of the Brazilian cruisers; and the same may be true of the 6-pounders. Their 1-pounders will probably have to be supplied with English ammunition. It has been stated in the daily press that the Navy Department, having acquired some 4.7-in. guns with these cruisers, would proceed to buy more guns of the same caliber abroad; but in fact the department has not bought any rapid-fire guns abroad and does not intend to buy any.

On the subject of ammunition, it may be added that in our navy the only high explosive regularly employed is gun-cotton, and that only in the torpedoes. The Navy Department is experi-

menting with jovite as a bursting charge for shells, but it has so far been used with large calibers only, and the whole matter is yet in an experimental stage.

The "Amazonas" has twin screws, each driven by one vertical inverted triple-expansion engine of the usual marine type, to give 3,750 I. H. P. The estimated speed is 20 knots to 20.25 knots. The coal consumption at full power is 1 kilogram (2.2 lbs.) per I. H. P. per hour. The normal coal supply is 700 tons; and the total 850 tons, giving her a steaming radius of 8,000 knots at 10 knots speed. At the time of going to press positive information as to the character of the "Amazonas's" boilers cannot be had. Thomas F. Lane, who represented the Armstrongs on this side in the transactions with the Government, says they are probably Bellevilles.

The "Amazonas" has had her acceptance trials for the Brazilian Government, but no data on the subject are obtainable. The "Barroso," however, completed her trials on April 30, 1897. She made a six hours' natural draft and four hours' forced draft trial. Under natural draft her mean speed was 19.5 knots; and under forced draft, 20.5 knots. On each trial she exceeded the contract speed by half a knot.

The owners offer, moreover, that both cruisers shall fulfil the British Admiralty's acceptance tests before acceptance by the United States, including stability tests and firing trials to test the resistance of the hull to firing shocks, to be made at the expense of the builders.

All materials employed in the vessels both for hull and machinery is of the highest quality, being in accordance with the specifications used by the British admiralty in the construction of British warships, and the workmanship is of the best. The contractors offer to make tests of workmanship and material according to the practice of the British admiralty, at their own expense. The United States is to be allowed to have small changes made to the extent of making the vessels like the British naval vessels of the same type, provided the cost of the ships is not thereby increased. The contractors also offered to repair, at their own expense, defects due to faulty construction or material discovered in a year.

The full complement of the "Amazonas" is 300 officers and men. The Armstrongs offered to put a navigating crew aboard and deliver her in any port designated by the United States; but instead the U. S. S. San Francisco was sent from Lisbon to Gravesend, England, to take possession of her, and she was accordingly delivered to the United States at Gravesend on March 18. The simple ceremony by which a vessel of war was then peaceably transferred from the flag of one country to that of another in the port of a third is said to be unique in naval history. Lieutenant Commander A. P. Nazro, U. S. N. executive officer of the "San Francisco" took command of the "Amazonas" and with a small crew, also drafted from the "San Francisco," will bring her across. It is expected that she will come under her own steam and in company with the "San Francisco."

There seems to be a disposition on the part of both the Navy Department and the Armstrongs to keep secret the price paid for these ships. It is known, however, that on March 17, a Treasury warrant was drawn for $1,689,621 in full payment for the "Amazonas" and part payment for the "Abrouill." The most reliable reports place the price for both at something over $2,500,000.

The "Abrouill" is a duplicate of the "Amazonas." She has been launched, but is not yet completed. She can be finished in a few months; just how soon is not known, but she is far enough advanced so that she can be towed over, and it is probable that she will be brought across at once in this way.

The "Amazonas" and her sister ship somewhat resemble our "Cincinnati" and "Raleigh." The points of resemblance and difference are best shown in the following table:

COMPARISON OF CRUISERS, CINCINNATI—AMAZONAS.

| | "Cincinnati." | "Amazonas." |
|---|---|---|
| Hull material | Steel | Steel, sheathed and coppered |
| Normal displacement | 3,213 tons | 3,450 tons |
| Length on water line | 300 ft. | 330 ft. |
| Beam, extreme | 42 ft. | 43 ft. 9 in. |
| Mean draught | 18 ft. | 16 ft. 10 in. |
| Maximum i. h. p. (estimated) | 10,000 | 7,500 |
| Maximum speed (estimated) | 19 knots | 20 knots |
| Normal coal supply | 350 tons | 700 tons |
| Total bunker capacity | 460 tons | 850 tons |
| Steaming radius at 10 knots | 3,000 knots | 8,000 knots |
| Protective deck { slopes | 2½ in | 3 in. |
| complete, { flat | 1 in. | 1¼ in. |
| Armor on gun positions | 4 in. | 4.5 in. |
| Torpedo tubes | 2 | 3 |
| Batteries | 10 5-in. rapid fire | 6 6-in. rapid fire |
| | 1 6-in. B. L. R. (bow chaser) | 4 4.7-in. rapid fire |
| | 8 6-pounders rapid fire | 10 6-pounders, rapid fire |
| | 2 1-pounders rapid fire | 4 1-pounders, rapid fire |
| | 2 Colt guns | 4 Maxims |
| | | 2 field guns |
| Total muzzle energy per min. | 175,268 foot tons | 231,896 foot tons |
| Weight of discharge per min. | 4,980 lbs. | 5,040 lbs. |

In addition to these protective decks the "Cincinnati" and "Raleigh" have a cofferdam worked along the water line just above the protective deck and filled with cellulose and other water excluding material.

The above table shows in a striking manner the remarkable strides made in naval construction in the last few years. When the "Cincinnati" and "Raleigh" were designed naval architects abroad regarded the claims made for them by Americans as to speed, protection and battery, as impossible of realization on their displacement and horse power. Yet now, when these ships have been in commission only three years and a half, we see them surpassed on every point, as shown by the above table, by vessels of practically the same displacement and of markedly less horse power. The fact that the ten-knot steaming radius of the later ships is more than double that of the earlier ones is remarkable.

**Negotiations for Other Foreign Ships.**

At the time of going to press the Navy Department is reported to be negotiating for the Italian "Varese," the Brazilian "Tupy" and the Argentine "San Martino." The "Tupy" is a torpedo gunboat, one of three sisters built by the Germania Co., Kiel, Germany. She was launched on November 15, 1896. She is 259.1 ft. long; 30.84 ft. beam; 10.17 ft. draught, and 1,014 tons displacement. Her armament is two 4.13 in., six 2.24 in., and four 1.46 in. rapid-fire guns, and three 17.72 in. torpedo tubes. One tube is in the bow and two are on deck. She is propelled by two triple-expansion engines, guaranteed to develop 5,918 I. H. P. under forced draft. The contract full speed is 23 knots. Her boilers are of the locomotive type and five in number. She is now about six months from completion.

Italy has started three "Vareses," all sisters. The first was sold to Spain; the second to Argentina and is the "San Martino" above mentioned.

The "San Martino" and the "Varese" are from the Orlando Bros., of Leghorn. They are armored cruisers of the following dimensions: Length, 328 ft.; beam, 58 ft. 8 in.; maximum draught, 24 ft.; displacement, 6,840 tons. Each has a belt of Harveyized nickel steel 8 ft. 3 in. wide along the water line, throughout the whole length. The belt armor has a maximum thickness of 6 in. tapering to 3 in. Above the belt armor is an armored central citadel of about two-thirds of the length of the vessel. The citadel armor is of Harveyized steel, 6 in. thick. The gun barbettes are 6 in. thick, and their bases are protected by athwartship armor bulkheads 6 in. thick. The broadside battery of 6 in. rapid fire guns is covered by an armor deck 1.9 in. thick. The protective deck is .8 in. thick behind the heavy armor amidships, and 1.45 in. thick at the ends. There is an armored conning tower 6 in. thick. The armament consists of two 10-in. rifles and ten 6-in. and six 4.7-in. rapid fire rifles, ten 6-pounders, ten 1-pounders, two Maxims and four torpedo tubes. They have twin screws, each driven by one triple expansion engine of 6,500 I. H. P. The estimated speed is 20 knots. The coal capacity is 1,000 tons and the complement 470. According to reliable reports these vessels cost $3,656,500 each.

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**Auxiliary Ships for the Navy.**

The intention of the Government to increase the fighting naval forces in the event of hostilities by the addition of armed mercantile cruisers has caused much speculation as to the ships which would be selected. An authoritative statement concerning this matter has appeared in a recent issue of the Army and Navy Journal which we here reprint:

Secretary Long has appointed a board to secure auxiliary ships for the navy, composed of Captain Frederick Rodgers, Chief Engineer A. F. Dixon, Naval Constructor J. G. Tawresey and Lieutenant Nathan Sargent, recorder. The board has been conducting its investigations in New York. The only vessel purchased thus far is the steam yacht Mayflower, built for Ogden Goelet. She was purchased last January by King Leopold, of Belgium, but for some reason was not taken abroad and was given into the hands of our government for a consideration of $430,000, and will be converted into a torpedo gunboat. The Mayflower is one of the largest and most completely finished pleasure vessels ever constructed for an American yachtsman. She is 275 ft. on the water line, 321 ft. from fiddlehead to taffrail, 36 ft. 6 in. beam, 30 ft. deep to the bridge deck at side, and draws 17 ft. 6 in. of water. Her rig is that of a brigantine, with fidded topmasts and jibboom, and she carries nine small boats, including a 32-ft. steam launch, two life- She can also pick up two 1-2 raters, if occasion should boats, three dingies, cutter, gig and electric launch. require. The yacht is divided by steel bulkheads into nine separate compartments, and is designed to float even if any two of these should be filled simultaneously with water. With a coal capacity of 530 tons, the Mayflower can steam more than 2,000 knots at full speed, or 6,000 knots at a speed of 12 knots. Two of the cylinders of her engines are 22½ in. in diameter, two of 38 in. and four of 40 in. and the stroke is of 27 in. The armament consists of two 3-pounders, two 1-pounders and two Colt's machine guns. It is proposed to substitute for the Mayflower's battery a more effective one, consisting of 4-inch, 6-pounder and 1-pounder rapid-firing guns and 2 torpedo tubes. The board is considering the purchase of other yachts and tugs for conversion into vessels of war. Sixty-three vessels have been placed at the disposal of the board for examination. Three are the American liners St. Paul, 11,629 tons; St. Louis, 11,629 tons; Paris, 10,668 tons; New York, 10,674 tons. The proposed armament for these is two 6-inch, ten 5-inch, ten 6-pounder and six 1-pounder guns. Six others are: El Rio, 4,664 tons; El Sud, 4,659 tons, El Norte, 4,659 tons; El Sol, 4,522 tons; Vigilancia, 4,115 tons; Seguranca, 4,033 tons. These can carry each eight 5-inch, four to six 6-pounder and two to four 1-pounder guns. Fifteen others are vessels of from 3,000 to 4,000 tons; thirty are of from 2,328 to 2,982 tons, and four from 1,503 to 1,892 tons. They will carry six 5-inch or 4-inch, four to six 5-pounder and two 1-pounder guns. The San Juan, 2,076 tons; San Blas, 2,075 tons, and Manhattan, 2,080 tons can each carry four 5-inch, four 6-pounder and two 1-pounder guns. This would make a total armament for all of these vessels, if they were accepted, of eight 6-inch, 208 5-inch, 139 4-inch, 216 6-pounder, 114 5-pounder and 158 1-pounder guns; in all 913 guns on 63 vessels, aggregating 208,691 tons.

In addition to the above alterations to the "Mayflower," her side plating will be reinforced from about 2 ft. below the water line to about 5 ft. above it, to a thickness of 7-8 in., as a protection against small arm fire.

Washington advices report other vessels acquired by the government including the yachts Columbia, Hermione, Almy and Alicia, and the tugboats DeWitt C. Ivins, P. H. Wise, Walter A. Luckenbach, Winthrop, El Toro, Hercules and Atlas; these to be renamed and put in charge of naval officers as follows: "Hermione" to "Wasp," Lt. Ward; "Almy" to "Eagle," Lt. Southerland; "Alicia" to "Hornet," Lt. Helm; "Luckenbach" to "Uncas," Lt. Brainard; "Winthrop" to "Osceola," Lt. Purcell; "Wise" to "Sioux," Ensign Gherardi; "El Toro" to "Algonquin," Ensign Crosley. The "Chalmette" of the Morgan Line was surveyed with a view to fitting her out as a fleet repair ship.

### Congressional Shipbuilding Program.

Legislation for the construction of new vessels for the navy is still in embryo. The House Naval Committee has decided to recommend three new battleships, six torpedo boats, and six torpedo boat destroyers. The Senate has passed an appropriation of $260,000 for a new gunboat to take the place of the old sidewheel "Michigan" on the Lakes.

The Senate has also passed an appropriation for eight new vessels for the Revenue Cutter service, as follows: One to take the place of the revenue steamer Seward, cost not to exceed $160,000; one to take the place of the revenue steamer McLane, cost not to exceed $160,000; one to take the place of the revenue steamer Colfax, cost not to exceed $160,000; one to take the place of the revenue steamer Boutwell, cost not to exceed $160,000; one for service on and in the vicinity of the Columbian River Bar, Pacific coast, cost not to exceed $250,000; one for harbor service at Philadelphia, Pa., to replace the revenue steamer Washington, cost not to exceed $45,000; one for harbor service at Boston, Mass., to replace the revenue steamer Hamlin, cost not to exceed $45,000; one for harbor service at New York, to replace the revenue steamer Chandler, cost not to exceed $45,000.

Designs are being prepared for the cutter for the Columbia river, which will be of the following dimensions: Length, 170 ft.; beam, 29 1-2 ft.; depth of hold, 15 ft.; draught, 8 ft.; displacement, 650 tons.

### Proposed New Dock Facilities.

The general activity in naval circles has revived interest in the matter of dry docks. Last summer the Secretary of the Navy appointed a Board of naval officers, whose senior member was Commodore F. M. Bunce, U. S. N., to consider the subject of dry docks required by the Government. To avoid threshing over old straw we repeat here only the Board's summary of its own report in the tables on this page.

In addition the Board recommended that separate systems of docking should be provided for torpedo and other small vessels of a size in porportion to these classes.

Docks Urgently Needed.

| | Time Needed for Construction. | Cost. |
|---|---|---|
| Boston: Concrete dock 750 ft. long.. | 2 years | $1,350,000 |
| New York: Concrete dock 500 ft. long | 2 years | 1,200,000 |
| Norfolk: Concrete dock 500 ft. long (alternate to Newport News).... | 2 years | 1,100,000 |
| Lengthening present stone dock with concrete 150 ft..... | 1 year | 160,000 |
| Port Royal: Construction of wharf and slightly widening lower alters of dock..... | 6 months | 75,000 |
| New Orleans: (Algiers) Steel floating dock, moorings and wharf..... | 10 months | 750,000 |
| Mare Island: Concrete dock 500 ft. long ..... | 2 years | 1,100,000 |
| | | $5,735,000 |

With reference to the dock for New Orleans the Board reported as follows:

This dock should be capable of lifting a vessel of 15,000 tons displacement and 27 ft. draught of water. It is recommended that a wharf be built along the water front of the government reservation at Algiers, to be an adjunct to the dock. The latter will be moored and will operate in deep water off shore, and when a vessel is lifted dock and ship can be hauled together alongside the wharf and the ship be easily accessible to workmen from the naval station. A steel floating dock is selected for this situation for the following reasons:

(1.) Changes in water level from high and low river do not affect its operation. [The usual differences between high and low river at New Orleans is about 16 ft.]

(2.) It is located in fresh water and expense of maintenance will be small.

(3.) Great depth of water within mooring distance of wharf.

(4.) Rapidity with which a floating dock can be constructed to meet the urgent need for a dock on the Gulf of Mexico.

The Secretary of the Navy requested from Congress legislation on the lines of the Bunce Board's report. The Senate Naval Committee has not yet acted on the matter. The House Naval Committee just reported in favor of dry docks as follows:

One at Portsmouth, N. H., of stone or concrete, not less than 500 ft. long.

One at Boston of timber, 750 ft. long.

One at League Island, Philadelphia, of timber, 750 ft. long.

One at New Orleans of steel, floating, capable of docking a ship of 15,000 tons.

One at Mare Island, California, of timber, 500 ft. long.

All the above docks are to have 30 ft. of water over the sill at mean high tide and are to be of sufficient width to take the largest ships.

To render effective such a dock as is proposed at Mare Island, extensive dredging operations will be necessary, as a draught of water only 22 ft. can now be carried through San Pablo Bay, and only 19 ft. up the Napa river to the Navy Yard. In fact a fleet of dredges has been at work in the Napa river between Vallejo and Mare Island for more than six months.

Docks Recommended as Additional, to Place the Docking Facilities of the Country on an Adequate Footing.

| | Time Needed for Construction. | Cost. |
|---|---|---|
| New London: A fresh-water basin and dock connecting basin with river ..... | 2 years | $1,000,000 |
| Newport News: Steel floating dock and moorings (alternate to Norfolk concrete dock)..... | 10 months | 650,000 |
| Tortugas: Steel floating dock and moorings..... | 10 months | 650,000 |
| San Francisco: Concrete dock on Yerba Buena Island, 750 ft. long. | 2 years | 1,550,000 |
| San Pedro: Concrete dock 750 ft. long | 2 years | 1,550,000 |
| | | $5,400,000 |

It is expected that the floating dock for New Orleans if authorized will be made self docking, in sections, probably three.

The failure of the House Naval Committee to

recommend a dock at Newport News, Va., has been severely criticised in some quarters. On this account the following extract from the Bunce Board's report is of special interest:

The deep and protected waters at the mouth of the James River estuary are regarded by the board as one of the most important positions on the entire coast. In this neighborhood it is essential that there should be a dock capable of taking ships of the largest size, and facilities for making repairs of every character. Were the water approaches of a nature to warrant, the Norfolk Navy Yard would be the proper location for such a dock, but the channel from the open water of Hampton Roads to the Navy Yard is ten miles long through narrow and dredged channels, has a depth of but 25 ft. at low water, and is so narrow that the accidental sinking of any large vessel in it would effectually block the fairway. The board is therefore of the opinion that Norfolk in its present condition is not a proper place for the largest type of dock required by the strategical importance of the location. At Newport News are sufficient water and good conditions generally for a first-class floating dock, and at this place a steel double sided combined floating and graving dock is recommended, unless the channel from Hampton Roads to Norfolk be increased, concurrently with the building of the dock at Norfolk, to a width of 400 ft. and a depth of 30 ft. at mean low water, in which event the recommendation of the board is that the concrete graving dock referred to under Norfolk Navy Yard be constructed. * * * The board, learning that the Newport News Shipbuilding and Dry Dock Co. contemplated building a second dry

CHILIAN ARMORED SHEATHED CRUISER O'HIGGINS—FOR DESCRIPTION SEE PAGE 8.

dock at their works, opened a correspondence with the company, by authority of the department. * * * The president of the company also appeared before the board and stated that in the construction of its dock the company would gladly be governed by the wishes of the department as to its materials, size, character, and would enter into any fair agreement with the department as to its use by the government. The company is also willing to immediately commence the building of a dock and prosecute the work to completion with all possible speed, one year being specified by the president as the probable extreme limit of time required.

C. B. Orcutt, president of the Newport News Shipbuilding and Dry Dock Company, has at this time notified the Navy Department that work would shortly be commenced upon the new dock. It is proposed to make it 900 ft. long and of proportionate beam, and to cost probably $1,000,000.

With reference to Tortugas the Bunce Board reported:

The board recommends that a double sided steel floating and graving dock be located at Tortugas, in the inner harbor, using the natural basin of the entrance of the inner harbor for docking and undocking in case dredging a basin is found to be impracticable during the improvements of the channel, as recommended. Tortugas harbor is selected for the strategical reasons stated in the report of the Gulf Dock Commission, 1891, from its advantageous position in relation to the commerce of all the ports of the Gulf of Mexico, being about equally distant from the principal centers of trade on the Gulf, and from its remarkable advantages as a coaling and supply station for heavy ships * * * Tortugas from its position bears the same relation to the Gulf of Mexico as Gibraltar to the Mediterranean.

At present battleships would have to anchor one quarter mile from Fort Jefferson, Tortugas, and coal from lighters. During the current month, however, a contract has been let for dredging about 300,000 ft. about Fort Jefferson. This will bring the ship channel to a uniform depth of 30 ft. and will enable battleships to coal at the wharves without difficulty. The Alabama Dredging and Jetty Company of Mobile, got the contract at 38 cents per cu. yd. Within the next month two coal houses of 20,000 tons capacity will be erected at Fort Jefferson. Two new coal wharves, and an electric plant for lights, searchlights, and cranes, are also proposed. Altogether the Navy Department will spend more than $500,000 on Tortugas.

The War Department will mount a few modern guns at Fort Jefferson and man them with two batteries of artillery.

About $115,000 will be spent at Key West also, mostly on new coal sheds.

### Purchase of War Materiel.

A line on the cost of a modern naval engagement can be had by an inspection of the prices which the Navy Department has agreed to pay for projectiles, to be manufactured by various concerns. The contracts recently made were with the Firth-Sterling Company, the Midvale Company, and the Carpenter Steel Company, all of Pennsylvania, for 13-in. shells $1,100 each, 12-in. shells $1,000, 10-in. shells $850, 6-in. shells $250, 5-in. shells $100, 4-in. shells $96.00. Extensive contracts have also been entered into by the Navy Department with powder manufacturers and cartridge manufacturing concerns, and also for torpedo gear and supplies.

### Crusiers O'Higgins and Christobal Colon.

The Chilian cruiser O'Higgins, which was reported as sold to Spain is a product, like the "Amazonas," and the "Abrouill" of the Armstrongs' yard at Elswick. She was launched in May last and is now rapidly approaching completion. The length on the load water line is 412 ft.; beam, 62 ft. 9 in.; displacement, 8,500 tons; and mean draught, 22 ft. Her hull is of steel, sheathed with teak and coppered. Her armament consists of four 8-in., ten 6-in., four 4.7-in., ten 12-pounders, ten 6-pounders, four Maxims, and three torpedo tubes. Her guns are all Elswick quick-firers of the types described in the table given in a preceding article. She has the usual protective deck, which is from 1.5 in. to 2 in. thick. Along the water line for the greater part of her length she has a belt of Harveyized steel 7 ft. wide and 7 in. thick, tapering to 5 in. The turrets and barbettes of the 8-in. guns and the casemates of the 6-in. guns are of nickel steel, 6 in. thick. She has also a conning tower of 9 in. Harveyized steel. From this the voice pipes, engine room telegraphs, and electric call wires pass below through a heavy armored tube. There is the usual coal protection. She has two triple-expansion engines, each in its own watertight compartment, and twin screws. The total I. H. P. is 16,500. The guaranteed speed is 21 1-2 knots. The boilers are Bellevilles. The total coal capacity is 1,200 tons. She is supposed to have cost nearly $5,000,000.

The Italian cruiser Guiseppe Garibaldi lately acquired by the Spanish government and renamed the "Christobal Colon" is a powerful ship of about 6,800 tons. She was built at the Italian yard of Ansaldo & Co. Her dimensions are: Length, 328 ft.; beam, 59 ft. 9 in.; and draught, 23 ft. 3 in. In general appearance she somewhat resembles our "Indiana." Her armament includes two 25cm. breech-loading rifles, placed in end barbettes. Also ten 15cm. guns, five on each broadside, and six 12cm. guns, ten 57mm. guns and ten 37mm. guns of the rapid-fire pattern. She is fitted with twin screws, and engines with cylinders 42 in., 63 in. and 93 in. by 46 in. stroke. The boilers are water-tube, of the Niclausse type. Her indicated horse power on trial with natural draught was 10,670, and her mean speed 19.35 knots. Electricity is extensively used for auxiliary purposes, such as working ammunition hoists, training guns and handling the search lights.

Our thanks are especially due to Thomas F. Lane, the Washington agent of the Maxim Nordenfeldt Guns and Ammunition Co., Ltd., for courtesies.

## AMENDMENTS TO THE STEAMBOAT RULES AND REGULATIONS NOW IN FORCE.

At the recent meeting of the Board of Supervising Inspectors of Steam Vessels, held in Washington, a number of amendments to the existing regulations were decided upon. These have been approved by the Secretary of the Treasury and now have the force of law. James A. Dumont, Supervising Inspector General, and President of the Board of Supervising Inspectors has issued the amendments in the form which we here present, with this notation:

"Following is the text of the rules amended in port only, the parts stricken out enclosed in brackets [thus] while the additions to such paragraphs are printed in *italics*. Entirely new sections and paragraphs of sections are in plain type preceded by the word (new) in parenthesis."

### AMENDED RULES.

**Rule I.**

SECTION 3. (Fifth paragraph.)

The sample must show, when tested, an elongation of at least 25 per cent. in a length of 2 inches for thickness up to one-fourth inch, inclusive; in a length of 4 inches, for over one-fourth to seven-sixteenths, inclusive [in a length of 8 inches, for over seven-sixteenths to 1 inch, inclusive; and in a length of 6 inches, for all thickness over 1 inch]; *in a length of 6 inches for all plates over seven-sixteenths inch thickness and under one and three-fourths inches thickness.*

SECTION 6. (First paragraph.)

* * * All steel plate over three-fourths inch thickness, *and less than one and three-fourths inches thickness*, shall show a reduction of not less than [forty (40) ] *32.5 per cent.*

**Rule II.**

SECTION 2. (Second paragraph.)

All boilers built for marine purposes after July 1 [1897] *1898*, shall be required to have all the rivet holes [in the shell] "fairly drilled" instead of punched, and the longitudinal laps of their cylindrical parts double riveted, to be entitled to 20 per cent. additional pressure. [Also that steel plates of one-half inch thickness and over for all boilers shall have all the rivet holes in the shell "fairly drilled" instead of punched.]

SECTION 6. (First paragraph.)

No braces or stays hereafter employed in the construction of boilers shall be allowed a greater strain than six thousand (6,000) pounds per square inch of section, and no solid or hollow screw stay bolt shall be allowed to be used in the construction of marine boilers in which salt water is used to generate steam unless said screw stay bolt is protected by a socket. But such screw stay bolts without socket may be used in staying the fireboxes and furnaces of such boilers and elsewhere when *such screw stay bolts are drilled at each end with a hole not less than one-eighth inch diameter to a depth of at least one-half inch beyond inside surface of sheet*, when fresh water is used for generating steam in said boilers (*to take effect on and after July 1, 1898, on all boilers contracted for or construction commenced on or after that date*). Water used from a surface condenser shall be deemed fresh water. The flat surface at back connection or back end of boilers may be stayed by the use of a tube, the ends of which being expanded in holes in each sheet beaded and further secured by a bolt passing through the tube and secured by a nut. An allowance of steam shall be given from the outside diameter of pipe. For instance, if the pipe used be 1½ inches diameter outside, with a 1¼-inch bolt through it, the allowance will be the same as if a 1½-inch bolt were used in lieu of the pipe and bolt. And no brace or stay bolt used in a marine boiler will be allowed to be placed more than 10½ inches from center to center *to brace flat surfaces* on fireboxes, furnaces, and back connections; nor on these than at a greater distance than will be determined by the following formulas: *Flat surface on heads of boilers may be stiffened with doubling plate, tees, or angles.*

SECTION 6. (Second paragraph.)

The working pressure allowed on flat surfaces fitted with *screw stay bolts riveted over*, screw stay bolts and nuts, or plain bolt with single nut and socket, or riveted head and socket, will be determined by the following rule: * * *

SECTION 6. (Seventh paragraph.)

Flat part of boiler-head plates when braced with bolts having double nuts and a washer at least one-half the thickness of head, where washers are riveted to the outside of head, and of a size equal to seven-eighths of the pitch of stay bolts, or where heads have a stiffening plate, *either on inside or outside*, covering the area braced, will equal the thickness of head and washers. * * *

SECTION 8. (First paragraph.)

8. The following table shall include all riveted and lap-welded flues exceeding 6 inches in diameter and not exceeding 40 inches in diameter, not otherwise provided for by law.

*For any flue requiring more pressure than is given in table, the same will be determined by proportion of thickness to any given pressure in table to thickness for pressure required, as per example:*

*A flue not over 19 inches diameter and 3 feet long requires a thickness of .39 of an inch for 176 lbs. pressure, what thickness would be required for 250 lbs. pressure?*

*176 : .39 : : 250 : .5539, or a thickness of .554 inch.*

*Or if .39 inch thickness gives a pressure of 176 lbs., what will .554 inch thickness give?*

*.39 : 176 : : .554 : 250 lbs. pressure required.*

* * *

SECTION 13. Repealed.

[Riveted and lap-welded flues exceeding 6 inches in diameter, and not exceeding 40 inches in diameter, required to carry a working steam pressure per square inch exceeding the maximum steam pressure prescribed for any such flue in the table of section 8 of this rule, shall be constructed under the provisions of section 15 of this rule, and limited to the working steam pressure therein provided for furnace flues; but in no case shall the material in any such riveted or lap-welded flue be of less thickness for any given diameter than the least thickness prescribed, in the aforementioned table, for flues of such diameter.]

SECTION 15. (Third paragraph, page 33, Rules and Regulations, 1897, amended.)

All vertical boiler furnaces constructed of wrought iron or steel plates, and having a diameter of over 42 inches or a height of over 40 inches, and crown sheets of flat-sided furnaces, if made with a radius of over 21 inches, and all cylindrical shells of back connections having a radius of over 21 inches, shall be stayed [with bolts] as provided by Section 6 of Rule II, for flat surfaces: *But the cylindrical shell of bottom of back connections may be stiffened by angles or tees secured with rivets spaced no more than 6 inches from center to center, the distance from center of rivets at edge to center of tee, or from center to center of tees, not to exceed 24 inches, tees and rivets to be of suitable section for the pressure and radius of surface braced.* * *

SECTION 21. (Addition to second paragraph, new.)

*Provided*, That manhole opening in front head of externally-fired boilers, under the flues, as required by Section 4434, United States Revised Statutes, shall be of dimensions not less than 8 by 12 inches in the clear.

SECTION 38. (Second paragraph, page 42, Rules and Regulations, 1897.)

When holes exceeding 6 inches in diameter are cut in boilers for pipe connections, man and hand hole plates, such holes shall be reinforced, *either on the inside or outside of boiler, with reinforcing plates, which shall be securely riveted to the boiler, rivets spaced as for stay bolts as determined by Section 6, Rule 11, such reinforcing material to be of* [with] wrought-iron or steel rings of sufficient width and thickness of material to equal the amount of material cut from such boilers.
* * *

**Rule V.**

SECTION 1. (New paragraph following first paragraph.)

Mates, assistant engineers, or second-class pilots serving under five-years license, entitled by license to raise of grade, shall have issued to them new licenses for the grade for which they are qualified, the local inspectors to forward to the supervising inspector-general the old license when surrendered, with the report of the circumstances of the case. New licenses may also be issued in the case of license lost by wreck, fire or any other cause, upon a satisfactory showing of such loss to the inspectors, duly sworn to.

SECTION 1. (New paragraphs at end of section.)

Applicants for license as master or pilot of steam vessels of the naval militia, after passing an examination for color blindness, may be examined by the inspectors as to their knowledge of the pilot rules and handling of vessels, and if the applicant be found qualified in the judgment of the inspectors he may be granted a special license as master or pilot on such vessels on the waters of the district in which such license is granted, and for no other purpose.

All licenses issued to officers of the naval militia provided for in the preceding paragraph of this section, or in section 3 of this rule, shall be surrendered upon the party holding it becoming disconnected from the naval militia by resignation or dismissal from such service; and no license shall be issued as above except upon the official recommendation of the chief officer in command of the naval station of the state in which the applicant is serving.

The following classes of engineers are omitted from section:

[Chief engineer of condensing freight, towing and fishing steamers; chief engineer of non-condensing freight, towing and fishing steamers; first assistant engineer of condensing freight, towing and fishing steamers; first assistant engineer of non-condensing freight, towing and fishing steamers; second assistant engineer of condensing freight, towing and fishing steamers; third assistant engineer of condensing freight, towing and fishing steamers.]

SECTION 2. (New paragraph preceding classification of "Second Assistant" engineers.)

Any assistant engineer of ocean steamers of 1,500 gross tons burden and over, having had actual service in that position for one year, may, if the local inspectors in their judgment deem it advisable, have his license endorsed to act as chief engineer on lake, bay, sound or river steamers of 750 gross tons or under.

SECTION 3. (New paragraph.)

Any applicant for license as chief engineer or assistant engineer of steam vessels of the naval militia may be examined by inspectors and granted a special license as such, and for no other purpose, if, in the judgment of the inspectors, he be qualified. [See last paragraph of Section 1 of this rule.]

SECTION 5. (Amended.)

5. No person shall receive an original license as engineer or assistant engineer, except for special license on small pleasure steamers of 10 tons and under, and ferryboats, sawmill boats, pile-drivers, and other nondescript similar small vessels, navigated outside of ports of entry and delivery, who has not served at least three years in the engineer's department of a steam vessel, *a portion of* which experience must have been obtained within [two] *three* years preceding the application.

SECTION 5. (New paragraph at end of section.)

Any person may be licensed as engineer (on Form 2130½) on vessels propelled by gas, fluid, naphtha, or electric motors, of 15 tons gross or over, engaged in commerce, if in the judgment of the inspectors, after due examination in writing, he be found duly qualified to take charge of the machinery of vessels so propelled.

SECTION 6. (New paragraph at end of section.)

Any person owning a pleasure yacht of 15 tons and under, navigated for pleasure only, holding a master or pilot license, is fully authorized to navigate his own pleasure yacht, cruising in the inland waters of the United States, without being required to report to the various boards of inspectors whose districts they may be passing through.

SECTION 10. (Last paragraph.)

[No original first-class pilot license on the Northwestern lakes shall be issued hereafter to any person who has not been licensed and served at least one full season of eight months as second-class pilot on steamers, such service as second-class pilot to have been within two years preceding the application for such license.]

*On the Northwestern Lakes and connecting waters, any person holding a second-class pilot license may come before any local board for examination for first-class pilot license, after having served one year as wheelsman, watchman, or as assistant to a first-class pilot on freight, towing, or passenger steamers, such service to have been within two years preceding the application for raise of grade.*

SECTION 14. (New paragraph at end of section.)

First-class pilots, who have served as such on the waters of the Atlantic or Pacific coast inland waters, or on the Great Lakes, on steam vessels of 1,000 tons and upward, may have their licenses endorsed for masters of steam vessels of 500 tons and under, on the same waters, without examination, when the inspectors are satisfied of their qualifications therefor.

SECTION 19. (Last paragraph repealed.)

[All examinations for licenses to be made by the board of local inspectors.]

SECTION 8. (Last paragraph.)

And it shall also be the duty of the inspectors to compel all floating structures, such as steam elevators (propelled by their own motive power), to have their whistles located on the front side of such superstructures having an elevation higher than the pilot house of the vessels. [This amendment to take effect July 1, 1897.]

SECTION 8. (New paragraph at end of section.)

All steam whistles shall be placed not less than six feet above the top of the pilot house of steam vessels where the height of the smoke stack will admit the attachment of same below its top, when not hinged for passing under bridges, and it shall be the duty of inspectors to enforce this rule at the annual inspection.

It shall be the duty of all inspectors before granting an original license or renewing an existing one to a master or pilot of steam vessels for any waters, to satisfy themselves by an examination in writing, that such officers are thoroughly familiar with the pilot rules upon the waters for which they are licensed.

Each master and pilot of steam vessels, wherever employed, shall, when receiving his license (either original or renewal), be furnished with a pamphlet copy of the Rules and Regulations governing pilots and of the statutes upon which such rules are founded applicable to the waters on which their licenses are intended to be used as stated in the body thereof.

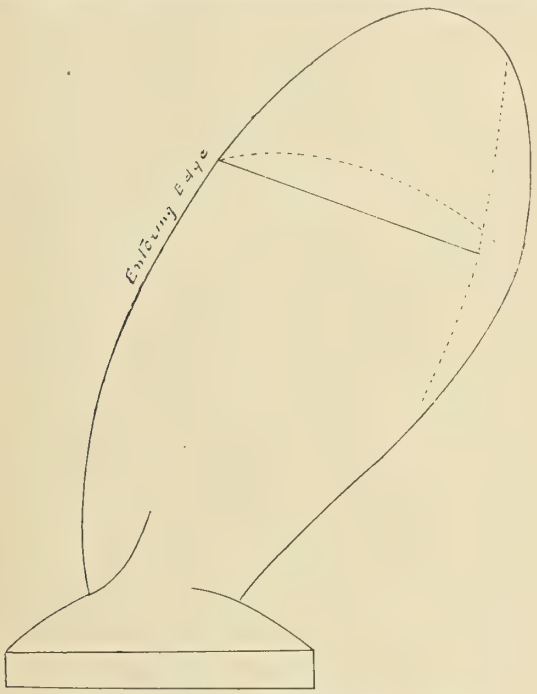
## A CURIOUS PHENOMENON IN PROPELLER BLADES WITH SUGGESTION AS TO ITS CAUSE.

BY P.A.E. W. STROTHER SMITH, U.S.N.

During the recent overhauling of the American Line Steamship Paris, at the yard of the Newport News Shipbuilding and Dry Dock Company, the author noticed that a certain portion of the driving face of each one of her propeller blades was being chipped off, and there being strong evidence of method in this seeming madness, an investigation and discussion brought out the following facts and theories:

The propellers of the S.S. Paris have an expanding pitch, and it would not seem strange, perhaps, to alter the face of such a blade, but when the S.S. St. Paul arrived for docking and repairs it was noticed that her blades were chipped and faired about the same amount at the same place.

The propeller of the "St. Paul" is a true screw, bent back from the plane of rotation and the blades are curved radially away from the entering edge on the go-ahead motion. The expanded area is 93 sq. ft., the projected area 70.5 sq. ft., dia. 19 ft. 6 in., and the pitch 27 ft. and 6 in. at 14 ft. dia. The accompanying sketch of one of




BLADE OF PROPELLER OF ST. PAUL.

her blades shows the area faired away and the relative position thereof.

The facts are that for some time, at every period of docking the liners Paris, New York, St. Paul and St. Louis, their propeller blades were chipped and faired at the point shown in the accompanying sketch. It was claimed that this portion of the blade curled in toward the driving face, and in order to keep this face fair and the pitch as designed, it was necessary to chip off a wedge of metal varying from 3 to 4 ft. long at the back of the wedge to from 6 to 8 in. broad. As much as 3-8 in. has been chipped off at the leaving edge of the blade.

It is claimed that this decreases the slip by about 1 1-2 per cent., the same conditions of hull surface and state of wind and sea holding.

How to account for the fact that a metal should bend against a pressure is not an easy thing to do, and were it not on the assurance of good authority that such curling does take place, it would be passed upon as a matter of small importance and not to be believed. The mere fact that a company of such repute should take account of it is assurance enough to bring it to the consideration of marine engineers.

One theory advanced is that the tremendous pressure of the water on the blades would act in the same manner as a knife blade drawn across the face of a sheet of paper, curls it up toward the pressure.

From an extended experience in measuring propeller blades with nearly exact instruments and in measuring blades over different points of their surfaces, the author has found that even in the most carefully made blades there are small hills and hollows. These uneven surfaces traveling through the water at such a high speed, would tend to form little eddies and bubbles which would in all probability leave the blade at just that point where the chipping is shown. As they are swept together there is reason to believe that a partial vacuum might be formed and the blade bending to the form of least resistance takes a permanent set.

When the liner Paris was recently overhauled, her propeller blades were polished with a buffing wheel, which, considering the enormous amount of surface friction, when the propellers are moving, should materially increase their efficiency. At the present writing she has just crossed the ocean, and it is to be regretted that very stormy weather prevented any comparison between this and some of her former runs.

It is a great pity that a more general use of exact instruments are not used on propeller blades at every docking of well known vessels, as then their performance could be watched intelligently by the engineering world; it would be of great benefit and would probably bring to light many interesting points not at present thought of. Notwithstanding the greater expense, propellers could be ground to an exact pitch at every point and then something definite could be known of their performance.

Until some scientifically minded engineer with large means at his disposal will make an extended set of experiments with ample provision for recording exact data and with every point watched, the designing of propellers will always be to a large extent in the nature of guess work. Reason and experience have done much, but the nearly exact science must wait until such experiments are made.

## NEW WHITE STAR FREIGHT AND PASSENGER TRANSATLANTIC LINER CYMRIC.

The ownership of the largest freight steamship afloat has again passed to the British flag in the new leviathan "Cymric." This latest addition to the great cargo fleet of the White Star line, trading between Liverpool and New York, reached this port last month on her maiden voyage. In general design she is of the Harland and Wolff type and when loaded is really a handsome vessel, getting a gracefulness of appearance from the rake of the big funnel and four pole masts which is notably absent in many recent big freighters. Her dimensions are: Length over all, 600 ft.; beam, 64 ft.; and depth, 42 ft. When loaded to 29 ft. mean she carries 12,500 tons, cargo in her holds and coal in the bunkers. Her measurement capacity is 19,000 tons of 40 cubic feet.

Strictly speaking the "Cymric" is not a freighter, but rather one of the growing type known as intermediate. This, of course, implies the addition of limited passenger accommodation to cargo capacity, and also medium speed. The "Cymric" carries only one class—saloon—and the accommodation for 120 passengers. This feature of the vessel is perhaps the most interesting, for otherwise she does not differ materially from many ships the builders have turned out. The spaciousness and convenience of arrangement of the passengers' quarters are exceptional. Accustomed to the accommodations on big liners the experienced sightseer could hardly believe himself on board ship. Each cabin is really a good sized room with two berths, upper and lower, a lounge, separate wash stands and a large clothes press. The passages are exceptionally wide and the toilet arrangements splendidly sanitary. In the matter of decoration, as in fact in all such details throughout the ship, there is a substantial plainness in which comfort and solidity are sought rather than showiness.

The saloon is amidship on the upper deck, and is capable of seating about 100 passengers. The dome of the saloon is fitted with a colored glass skylight, also emblematic side panels in plaster of pleasing effect. Pantries, galleys and officers' quarters are on this deck. Immediately above is the promenade deck, where are the passengers' staterooms. Proceeding up the main staircase, lighted by a colored glass skylight, and immediately forward of this, is the library, a pleasant apartment quietly decorated in carved oak panelling. The upholstery is of blue moquette. The furniture consists of writing tables and bookcase, and enticing arm chairs.

Aft of this comes the smoking room, lighted at the sides with large open square windows, and overhead with a colored glass dome. The walls are decorated with French embossed leather, and the furniture is of mahogany, Chippendale pattern. The floor of this room and the main passages and entrances have all been laid with rubber tiles which, besides their noiselessness, contribute greatly to reduce the risk of passengers falling in bad weather. The captain and officers are berthed in a separate house forward of the passengers' quarters, and on the top of this house is the captain's bridge.

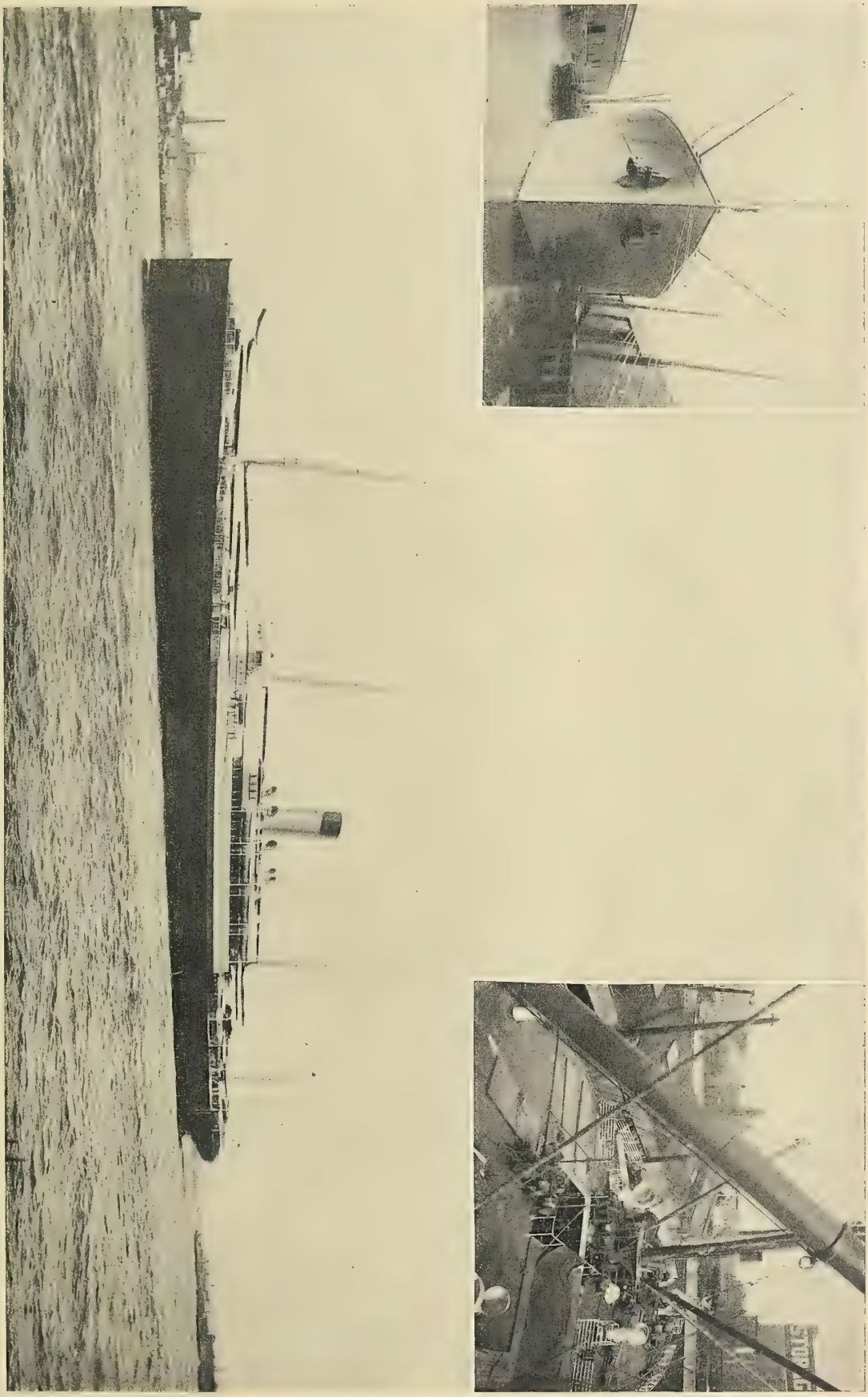
The "Cymric" is fitted with twin screws driven by quadruple expansion engines of about 7,000 I. H. P. of the type usually adopted by the builders, with independent cylinders. Steam is generated in Scotch boilers at 210 pounds per sq. in., natural draught being relied upon. The boiler installation is extensive, as owing to the number and size of the winches, and other auxiliary machinery, single-ended main boilers are used in port to furnish steam. The engine room extends the width of the ship, and is almost big enough to give a cycle path around the engines. In this there are fitted batteries of pumps, feed heaters, evaporators, besides a large refrigerating plant and on one of the upper gratings the electric lighting sets. A feature noticed in the engine room was the order "Dead Slow" on the ahead side of the telegraphs, and "Close Water-Tight Doors" on the astern side. The only serious defect in the machinery equipment appears to be the lack of an elevator, for it is quite an undertaking to run up and down the ladders from the berth deck to the starting platform.

Besides the cargo and passenger accommodation the "Cymric" has room for 850 head of cattle and 250 horses. She flies the Royal Naval Reserve flag, and is constructed so that she could be readily converted into a troop ship and carry an enormous number of men. She is said by her owners to be capable of a 16 knot speed on 100 tons and 13 knots on 80 tons coal consumption. She is fitted with bilge keels, and is described as being "as steady as a church" at sea.

## DETAILS OF CONSTRUCTION OF THE TWIN-SCREW STEAM YACHT NIAGARA.

In our last issue we briefly noted the launching of the twin-screw steam yacht Niagara at the yard of Harlan & Hollingsworth, Wilmington, Del. Through the courtesy of her owner, Howard Gould, of New York, we are now able to give interesting information and exact data about this full powered vessel. An excellent idea of the Niagara as she will appear when ready for sea can be had by an inspection of the accompanying sail plan. Though fitted with twin screws she is designed to carry a considerable spread of sail, barque rig, so that in long cruises the method of propulsion can be alternated between steam and sail.

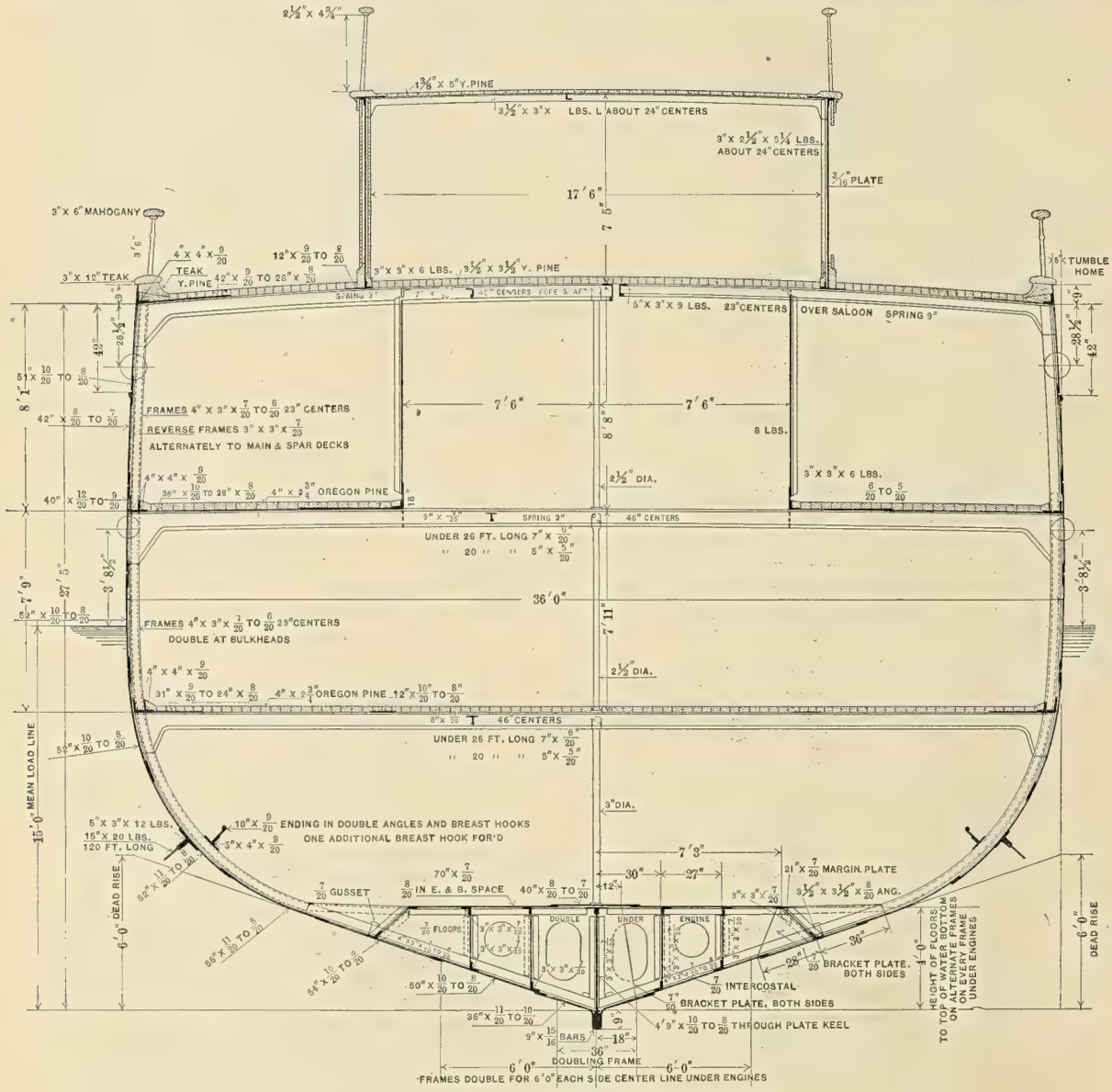
The yacht has been built according to the highest classification of the English Lloyds and American, United States, Standard being for 20 years rated under special survey. She is built of steel with main deck of steel throughout and spar deck partly of steel. Her dimensions are:



VIEWS OF THE WHITE STAR FREIGHT AND PASSENGER TWIN-SCREW STEAMSHIP CYMRIC—THE LARGEST CARGO CARRIER AFLOAT.

Length over all, about 272 ft.; length between perpendiculars (Lloyds measurements), 247 ft. 6 in.; breadth moulded, 36 ft.; depth to spar deck at sides, 27 ft. 5 in.; depth to spar deck at center, 28 ft. 2 in.; depth moulded to main deck at center, 19 ft. 6 in.; depth moulded to main deck at side, 19 ft. 4 in.

She has six water tight steel bulkheads and fore and aft bulkheads in the bunkers. These largely for skylight sills, for covering planksheers, and for waterways. Mahogany will be used for the rails and for the paneling of the deck house. The navigating bridge, which will be 7 ft. wide, will be framed in teak fitted with highly polished telegraphs and binnacle stand, and the other usual appliances. Special attention will, indeed, be given to all the deck fittings, the various ladders being handsomely mounted and




MIDSHIP SECTION OF TWIN-SCREW STEEL STEAM YACHT NIAGARA.

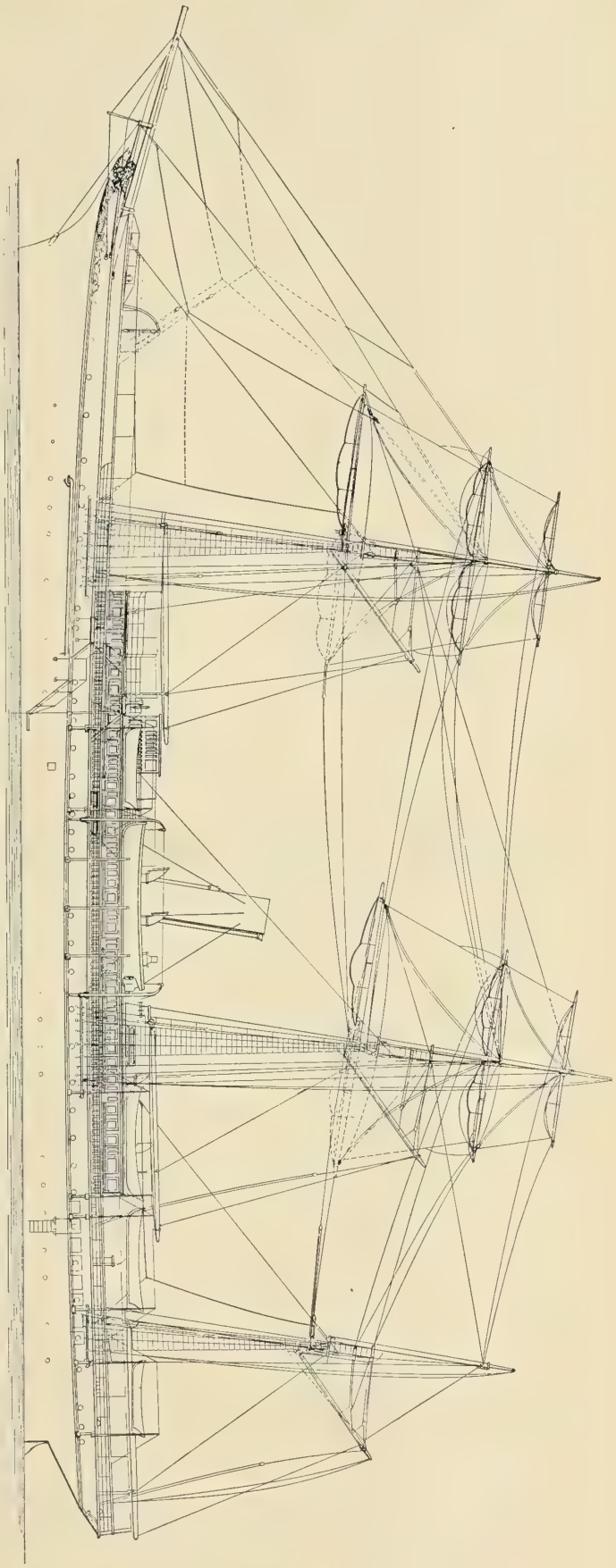
water tight 'thwartship bulkheads are of extra strength and thickness. The hull is divided into several independent compartments for additional safety, and a water bottom for the entire length of the ship is an additional protection. Bilge keels have been fitted for about 140 ft. in length and 15 in. deep, so it is expected she will be very steady in a seaway. The deck house will be of teak and this timber will be used fitted. The figure head and stern carving will be very artistically executed. The decks will be laid with fine white pine, except the lower, which will be of Oregon pine. There will be side lights of improved pattern in brass frames with cast iron shutters in the hull, and screw deck lights and dead lights for light and ventilation where necessary. Very great care has been taken with the design and obstruction of the rigging, blocks,

spars and lines. There will be a very complete installation of steam deck machinery, including steering gear, capstan and windlass forward, and independent steam capstan aft, together with a special steam winch on the forecastle for quick handling purposes, and a steam engine with two gypsys amidships for the sole purpose of hoisting the steam launches and small boats. An emergency hand screw gear will be placed aft. There will be eleven boats in all, including two steam launches.

The "Niagara" is constructed upon the Lundborg principle of protection to the outboard shafting, which is the same as is used in many large steamers. By this device the usual cast steel hangers which extend from the after part of the hull in two directions and meet in the boss supporting the outboard shafting close to the propeller wheel is dispensed with, and in its place the hull is carried out to enclose the shaft within itself and form an integral part of the structure.

The engineering features of this vessel are extensive. Two triple-expansion engines of the usual inverted type are fitted, each with cylinders 18 in., 28 in. and 45 in. by 30 in. stroke, taking steam from three Scotch boilers. These are 13 ft. 6 in. by 11 ft. 6 in. in the clear, each fitted with three 46 in. furnaces, and proportioned for a working pressure of 160 pounds per sq. in. There is also a donkey boiler of the Scotch type, 6 ft. 10 in. dia., and 9 ft. 2 in. long with one 40 in. furnace built to withstand 160 pounds steam pressure. An auxiliary condenser of 306 sq. ft. cooling surface is located in the engine room and provided with a combined air and circulating pump. The water cylinder of this pump is also connected with the water bottom of the vessel for discharging the same quickly in case of necessity for regulating the trim of the ship. This auxiliary condenser is intended to take care of the exhaust steam from the small machinery, such as electric light engines and pumps when the vessel is at anchor and the main engines are stopped. The usual pump equipment for a vessel of this size is fitted, and there is an ash ejector in the fire room.

The electric light plant consists of two direct connected dynamos and engines installed in duplicate, each set having a capacity of 400 16 c. p. lamps. These four pole generators are



SAIL PLAN OF THE TWIN-SCREW STEEL YACHT NIAGARA BUILT BY HARLAN AND HOLLINGSWORTH FOR HOWARD GOULD OF NEW YORK.

driven by 6 in. by 5 in. double enclosed Sturtevant engine running at a speed of 550 revolutions per minute under a boiler pressure of 100 lbs. The wiring of the ship has been done by the electrical staff of the builders, and the whole installation will be finished complete at their yard with their own expert workmen. The various outlets are grouped on six circuits and the insulation and wiring most approved, with all provisions possible for safety and artistic effect. The plant is provided with the usual instruments and spares for operation at sea. There will also be one polished brass, Rushmore pilot house projector, 18 in. dia. taking 45 amperes.

A storage battery of 40 lights capacity will also be installed.

The refrigerating plant is to consist of a Remington machine with a capacity for 400 lbs. of ice per day, and to cool 1,500 cu. ft. of space to a temperature of 34° F. The machine will have two 4 in. by 9 in. vertical single acting ammonia cylinders on one housing, operated by 7 in. by 7 in. vertical engine direct connected on the same base; also one ammonia condenser of the submerged type consisting of a salt water tank with ammonia liquifying coils of extra heavy pipe. There will be one steel brine tank, 5 ft. 4 in. long by 2 ft. 8 in. wide, and 36 in. deep, with removable covers, provided with the necessary ammonia expansion coils, and arranged to contain 15 galvd. ice cans with covers, to hold 50 lbs. cakes of ice, also one 3 in. by 2 in. by 3 in. duplex steam pump, brass mounted, for brine circulation, with brine gauge, lubricator and brass cased thermometer. A system of galvanized piping will be erected in the cold storage room and refrigerators for the circulation of the brine and governed by suitable valves and connections. There will be two ammonia gauges mounted on ornamental board, and one ammonia receiver and connecting pipes, valves and fittings for the system.

In connection with the machinery department there will be an evaporator and distiller plant of 15 tons capacity, fitted up complete.

The ship will be steam heated throughout with radiators, coils and pipes, the whole being trapped and discharged into the hot well or filter tank in the engine room.

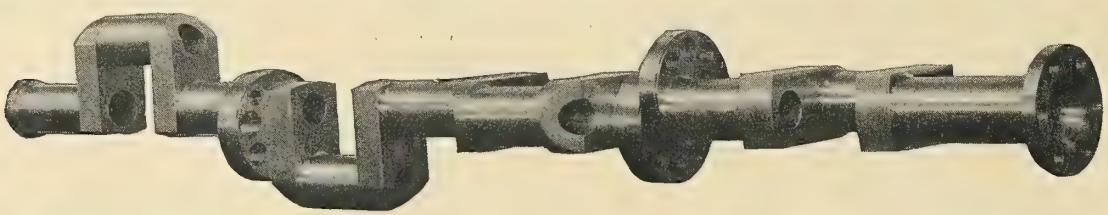
The plumbing system is very complete, consisting of salt and fresh water supply throughout the ship, lifted by steam pumps and the salt water waste being carried overboard and the supply tanks located on top of the deck house. Drains from all basins and tubs in the owner's and guests' quarters are led into a 500 gallon drainage tank in the hold and drains from all water closets in the owner's and and guests' quarters are led into sewage tanks located in the hold and thence pumped overboard by steam or water syphon blow. Ventilation is carefully looked after in every part of the system.

Fresh water tanks of 15,000 gallons capacity are fitted independent of the fresh water to be carried in the peak tanks. There is bunker capacity for 425 tons. At maximum speed the estimated horse power is 2,000, and with bunkers full and no water in the water bottom, but with all other weights on board a speed of 14 knots is looked for on a six hours' trial, running under natural draught.

We have not here given any description of the interior arrangements or furnishings, as many of the details have not yet been finally decided upon. When the yacht is ready for sea, however, we expect to give additional description of these matters. The hull construction can be readily seen by reference to the accompanying cross section.

### Nickel Steel Crank Shaft for Destroyer.

As an interesting example of modern practice in marine forgings we here present a reproduction of a photograph of a nickel steel four-throw crank shaft for the torpedo boat destroyer Farragut, now building at the Union Iron Works in San Francisco. This crank which was forged and machined by the Bethlehem Iron Co. at South Bethlehem, Pa., is 12 ft. 8 1-2 in. long. The journals and pins are 6 3-4 in. dia. and the diameter of the through hole is 4 in. As will be observed the forging is in one piece, with the eccentric sheaves in place. Every ounce of metal which could be spared is cut away, the lightening process even extending to the drilling of the eccentric sheaves. The Farragut is designed for a speed of 30 knots. Her dimensions are: Length, 210 ft.; beam, 20 ft. 4 in.; draught, 6 ft. Her displacement will be about 270 tons and her engines are expected to indicate 5,600 horse power. These will have cylinders 20 in., 29 in. and two 30 in. dia. by 18 in. stroke. They will have link motion and piston valves, and are designed to make 400 revolutions. The boilers will be of the Thornycroft water-tube "Desperate" type, to work at 240 lbs. pressure.



SOLID FORGED FOUR-THROW NICKEL STEEL CRANK SHAFT FOR THE "FARRAGUT."

## REVIEW OF ADMIRALTY LAW SHOWING ITS ORIGIN AND MODERN APPLICATION.*

BY ISAAC FRANKLIN RUSSELL, D.C.L., LL.D.

Admiralty jurisprudence is the most ancient and cosmopolitan body of law with which we are familiar. Some of its rules now generally enforced were formulated in the Rhodian law several centuries before the Christian era. Rhodes was then the center of commerce in the Mediterranean. Fragments of this ancient code are preserved in the Corpus Juris; for example, the rule of general average which still survives in the maritime law of to-day. Among the maritime codes of the Middle Ages we find the laws of Oleron, which, by an English fable, are ascribed to Richard Coeur de Lion, who stopped at the island from which the code takes its name on a visit to his mother-in-law, on his return from the Crusades. But law was not in the line of the lion-hearted king, and the story is apocryphal, being invented in order to credit England with some contribution to the maritime law. The Consolato del Mare and the marine ordinance of Louis XIV., the basis of the French Code de Commerce, deserve mention among the sources of the admiralty law.

The word ship is very general, and comprehends watercraft of every kind, merchantmen, gunboats and pleasure yachts; size and rigging are also immaterial, for every vessel that floats is in law a ship. Obviously, a vessel constructed to ply on the highway of nations cannot be real estate. Gunboats, however, by a fiction of law, are regarded as floating barracks.

A ship is a chattel, and is to be bought and sold under the law of chattels. In strictness of law a ship can be sold without writing; but practically this is impossible, because statutes require documentary proof of ownership before papers are issued from the office of the collector of the home port. And papers, a register for a ship in the foreign trade, and a license for a coaster, are in every case necessary for seaworthiness: They are as important as the helm or anchor. It is characteristic of admiralty that it treats of things as persons. A ship, for instance, is regarded as a responsible moral agent.

Repairs are charged to a ship in her own name, and payment is enforced against the ship herself by a proceeding against her, in rem. in which under a decree in admiralty she is sold and the proceeds applied according to law. So, too, a ship is regarded as having nationality as well as personality, and, further, like an ordinary citizen, as having a distinct domicile, or home port. The maritime law gives a lien to the material-man who furnishes repairs and supplies to a ship. But in the United States this is limited to foreign ships or ships of another State.

One of the most discouraging features of practice at common law is the familiar experience of the successful litigant in finding himself unable to satisfy his judgment; during the long course of the suit the defendant has become insolvent. Now, the admiralty begins where the common law leaves off, viz., by seizing the ship and holding her as security for such judgment as may be rendered. Her owners may secure her release by giving a bond. So, in actions against the owners, if defendants cannot be served personally by a writ of attachment the ship is attached. The marshal—who knows his business—is unable to serve the defendant personally, but always suceceds in seizing the ship.

Ships are seldom owned by a single individual outright; they generally belong to several persons called part owners. Of these the managing owner is called the ship's husband. The commander, or captain, is known in law as the master. He is the highest authority in the ship. He is not only agent of the owners by contract, but by necessity he is agent for all whose time, labor and fortunes are involved in a common venture. The master can sell the ship in case of necessity where he acts with ordinary prudence. As agent for all interested, he may even sell the cargo. The owners of a ship may sail her themselves, or they may lease her to others by a contract called a charter-party. The ship is bound to the cargo, and reciprocally, the cargo is bound to the ship. The ship must be seaworthy and make the voyage and deliver the goods in accordance with the terms of the contract; and as a carrier the ship owner has a lien on the cargo to enforce payment of freight. When the goods have been laden on the ship the lien attaches, and the ship has a right to earn freight, which right cannot be ignored by an attaching creditor.

A bill of lading is a written receipt for the goods shipped, and is signed by the master; it is often executed in triplicate. If an indorsed bill of lading be delivered to the consignee it entitles him to delivery of the goods shipped. Such a bill is quasi-negotiable; it may be hypothecated as security for money advanced, or it may serve as a muniment of title and facilitate symbolically the delivery of goods sold to arrive. The owner of a general ship, offering to take goods for all who may apply, is a common carrier, and as such is bound to answer for all loss except such as results from the act of God or the public enemy. By stipulation in the bill of lading, loss from the perils of the sea is also excepted. This expression means the extraordinary violence of wind and wave, wreck, stranding and capture by pirates or by the cruisers of a belligerent enemy. By act of Congress the ship owner is not bound to answer for loss arising from fire at sea not caused by negligence.

Collision is now the chief maritime peril. The ship in fault sustains its own loss and is bound to compensate the other party. The common-law rule of contributary negligence has no application in cases of collision. To encourage owners to assume the risks of maritime commerce

*From a lecture delivered before the Brooklyn Institute, New York.

the law limits the liability of the owners of the offending vessel to the amount of the value of the ship herself. So if the ship causing the loss or injury be herself sunk there is no responsibility.

Salvage is compensation earned in saving a ship or cargo exposed to maritime peril. There must be a marine peril, a voluntary service on the part of the sailors, and successful achievement. The master and crew of the ship in peril cannot be salvors, for their best service is always due as a consideration for their wages. But a passenger may be a salvor. The sum awarded is not in the shape of wages for services rendered at their ordinary rate and value; the money partakes rather of the character of a reward estimated in view of the nature of the peril to which the property saved was exposed.

Seamen are regarded as the wards of the admiralty and are protected by law against the overreaching schemes of landsmen. The exigencies of maritime service are such that disobedience may be punished with great severity; and mutiny, if need be, with death. The usual punishments are irons, confinement and hard labor; flogging has been abolished by statute. Desertion may be justified if the ship be unseaworthy or the provisions bad and unwholesome, or in case of cruel and inhuman treatment. Absence unexplained and without leave for forty-eight hours has been defined by some authorities as amounting to desertion.

Maritime and admiralty jurisdiction is vested by the Constitution in the Federal courts. It has been developed and expanded by those tribunals without the aid of statutory enactments. Procedure follows the system of the civil-law courts as distinguished from the common-law courts. The first pleading is called the libel, and the applicant for judicial relief is called the libellant. Legal practitioners are styled proctors, and much other technical language in admiralty is borrowed from the Roman law. The long and bitter controversy in England between the common-law courts and the admiralty resulted from a jealous regard for trial by jury, which the admiralty did not employ. Although federal legislation has provided for the use of a jury in admiralty cases it is seldom, if ever invoked. In strict admiralty practice the testimony of witnesses is taken before the final hearing; it is reduced to writing and the witness dismissed before the trial comes off before the judge.

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In the death of Nelson W. Perry technical journalism loses one of its most talented writers and an exceptionally fine man. Mr. Perry was a student in all fields of science and had the rare faculty of telling of complicated or abstruse things in such plain, simple language that anybody could understand him. He wrote a great deal, but was such a close observer that his articles were never diluted. Personally he was a delightful companion, and had many friends.

## ICE CRUSHING AND FERRY STEAMERS AT THE STRAITS OF MACKINAC.

BY W. D. HULBERT.

During the last sixteen years the Straits of Mackinac have been the scene of some remarkable experiments in winter navigation through fields of heavy ice. The Detroit Dry Dock Company has built three steamers especially for this work, and, although the first was a partial failure as an ice-crusher, the other two have been completely successful. The Algomah, launched in 1881, is a comparatively small vessel of 486 tons. She measures 128 ft. in length of keel, 33 ft. beam, and 14 ft. molded depth, and is driven by compound engines measuring 21 in. and 37 in. by 36 in. Her depth is greatest at the stern, and the keel rises forward till it rounds up out of the water somewhat like the nose of a whaleback. She was intended for use as a ram, and the hull was, therefore, made very heavy and strong, especially in the forward portion. The theory on which she was designed was that the peculiar shape of her bow would force the ice down under her, and that in striking a heavy floe she would rise upon it and crush it beneath her weight. She worked fairly well in smooth field ice, but experienced great difficulty in getting through the hummocks that were frequently met with, and was sometimes quite helpless until a passage was opened for her with dynamite. It was found, however, that she could sometimes make her way stern foremost through places where her ram was practically useless. To do this her stern was brought to bear against the obstruction, the vessel was made fast to the ice with anchors, and the engine was started ahead. The powerful current set in motion by the propeller heaved up the ice for a short distance around her stern, and broke it into fragments. The boat was then backed as far as possible into the broken mass, a new hold was taken with the anchors, and the operation was repeated. The success of these experiments led to the building of a larger boat, the St. Ignace, with a propeller at each end, the two wheels working in unison or against each other as is required. The one in the bow throws a current of water forward and breaks up the ice, while the stern wheel, which is larger and driven by more powerful engines, drives the boat ahead. The channel made is only wide enough to admit of the passage of the vessel, and frequently a man can jump from her side to ice sufficiently solid to sustain him. The same path is followed day after day, but it is often filled up with slush or broken ice which freezes in solidly and has to be broken open again, or by the movements of the floes in high winds. When not needed in opening a channel, the forward wheel can be used to assist the stern wheel in propelling the vessel.

The St. Ignace has a length of 232 ft., beam 50 ft. 10 in., and depth 24 ft. Her tonnage is

INSTANTANEOUS PHOTOGRAPHS OF ICE CRUSHING AND FERRY STEAMERS AT WORK IN THE STRAITS OF MACKINAC.

1,199.75. The propelling machinery consists of two compound engines, the forward one having cylinders 26 and 48 in. dia. by 40 in. stroke, while the after engine measures 28 in. and 53 in. by 48 in. Steam is supplied by three double-ended boilers, each 11 ft. 6 in. dia. by 18 ft. in length. The cars are loaded at the bow and are carried on two tracks laid upon the deck, one on each side, next the gunwale. The two funnels are ranged fore and aft in order that they may occupy less space between the tracks. The St. Ignace was the first boat on the Great Lakes to have her funnels arranged in this manner.

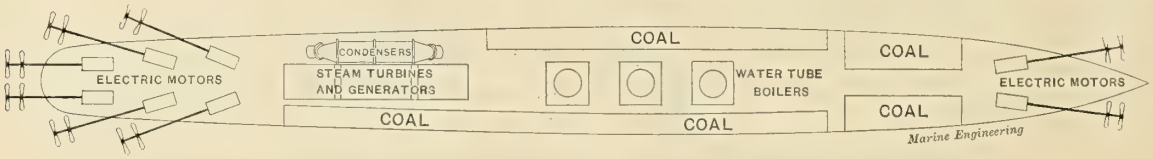
The Straits are roughest in westerly winds, and as the course of the ferryboats is about northeast and southwest they are frequently in the trough of a very heavy sea. The St. Ignace, with her proportionately great breadth of beam, is a very steady vessel, but it was thought advisable to increase her stability still further in order to avoid all danger of the cars being thrown from the tracks, and she was, therefore, fitted with two large anti-rolling tanks, which, it is claimed, very materially reduce the lateral motion. On top of her pilot house is a powerful electric search light, which is often of great assistance in picking a way through the ice-packs on a dark night, and which can also be used in lighting up the forward deck when loading or unloading cars. She is very heavily and substantially built, and in general appearance somewhat resembles a modern man-of-war. She was completed in the late winter or early spring, and was sent north while a large part of Lake Huron was still covered with ice about two feet in thickness. The voyage was

made without difficulty, and she is said to have maintained a speed of about five miles an hour throughout the greater part of it.

For several years the St. Ignace continued to handle the entire winter traffic of the Straits, and she seldom had any difficulty in navigating through the ice, but she was rather small for the amount of freight to be carried. In 1893 a larger vessel, the Ste. Marie, was constructed. Frank E. Kirby was her designer, and, like the other two boats, she was built by the Detroit Dry Dock Company. She is 269 ft. 6 in. in length of keel, 302 ft. on deck, 51 ft. 6 in. beam, and 24 ft. in molded depth. Her freeboard when carrying an ordinary load of eighteen freight cars is about 9 ft., and is none too great, as may be seen by the accompanying photograph. The hull is of the strongest possible construction, and her builders claim that it is the heaviest wooden hull on the Great Lakes. It is of oak for the most part, some long-leafed Georgia pine being used for deck beams and track stringers. The frames are 12 in. thick by 24 in. deep on the keel. There are 15 keelsons, none less than 14 in. square, and the vessel is planked with 6 in. of oak and sheathed with steel, up to 1-4 in. thick, to keep the ice from chafing her sides. Her coefficient of displacement is less than five-tenths, and her deep draught and fine form under water are important factors in her success. The upper deck of the hull proper is occupied by three tracks for car accommodation, one down the middle and one on each side, the cabins being carried overhead on the hurricane deck. The sides are sheathed up so that the cars are under cover in transit, and the usual appliances in the way of jacks and chains are used to steady them on the tracks. Owing to the length of the trip and the number of passengers carried, the cabin accommodations, dining saloon, toilet rooms, etc., are superior to those usually found on car ferries. Steam is furnished by four double-ended boilers, each 11 ft. 6 in. dia. by 17 ft. 6 in. long, working at a pressure of 120 lbs. to the sq. in. The funnels are four in number and are arranged in two pairs, rising on either side of the middle track. She has two vertical inverted compound engines of about 2,500 indicated horse power for ordinary working. The one which drives the bow wheel has cylinders 28 in. and 52 in. dia. by 40 in. stroke, while the after engine measures 32 in. and 58 in. by 48 in. The air pumps are of the Worthington independent duplex type, the size of the forward one being 12 in. by 15 in. by 15 in., and the after one 14. in. by 19 in. by 15 in. Feed pumps are also independent of the main engines, leaving only the bilge and circulating pumps to be worked direct. The auxiliary machinery comprises also four steam gypseys for handling lines, an engine for hoisting the gate at the bow under which cars must run in loading and unloading, and an engine and dynamo which supply current to 300 electric lamps and for the search light on the pilot house. Among the special fittings are four of the Dry Dock Company's hydraulic ash ejectors for getting the ashes overbard.

Like the St. Ignace, the Ste. Marie carries anti-rolling tanks to steady her in the high waves and rough cross seas of the Straits. As an ice-crusher she seems to be perfectly adapted to the work required, and her daylight trips are made as regularly in winter as in summer. A howling gale, loosening the floes and setting them in motion, sometimes causes her to cancel her night trip and remain at the wharf till morning, but even this is of very rare occurrence, and the delay in such cases is more a matter of prudence than of actual necessity. For the last four years she has done practically all of the car ferrying between the upper and lower peninsulas, the St. Ignace being held in reserve for use in case of accident to the larger boat or during the semi-annual overhauling which is given her every spring and fall to keep her in condition for her battles with the ice-pack.

The Mackinac ice-crushers have attracted a great deal of attention from naval architects all over the world, and the Russian government sent experts to examine them before deciding upon similar vessels for use in transferring cars across Lake Baikal, on the line of the Trans-Siberian Railway.




ROUGH SKETCH OF PROPOSED ELECTRICALLY DRIVEN TORPEDO BOAT.

### Proposed Electrically Driven Torpedo Boat.

We here print a rough sketch of a type of torpedo boat proposed by Richard B. Painton, which is the subject of a bill to be presented to Congress for an appropriation for the construction of such a boat for the Navy. The inventor is very hopeful of results, and his claims are correspondingly proportioned. By the use of his system, he says, it will be possible to attain double the speed reached by steam and at about one-half the cost. Ocean "greyhounds" equipped with the Painton motors are to "easily cover 40 knots an hour." As the sketch shows, the inventor proposes to fit his boat with water-tube boilers supplying steam to steam turbines direct-connected to generators, which will furnish current for the several electric motors attached to the propeller shafts. Multiple propellers are used so as to get

the required blade area on small diameter. In his prospectus the inventor declares his system of motors will have "enlarged power" over steam. How the enlargement of power is provided, however, is not stated. It is manifest that he would secure "enlarged" weight, and consequently displacement, for in addition to the boilers and turbines, such as are used in the "Turbinia," for example, he adds the weights of generators and motors besides the various controlling and measuring devices for the electrical current. In the best land practice, where weight is not a matter of first consideration, the drop in efficiency between the engine and electric motor is about 13 per cent., and in all rational discussion this would mean contraction rather than enlargement.

### Data on Propeller Investigations.

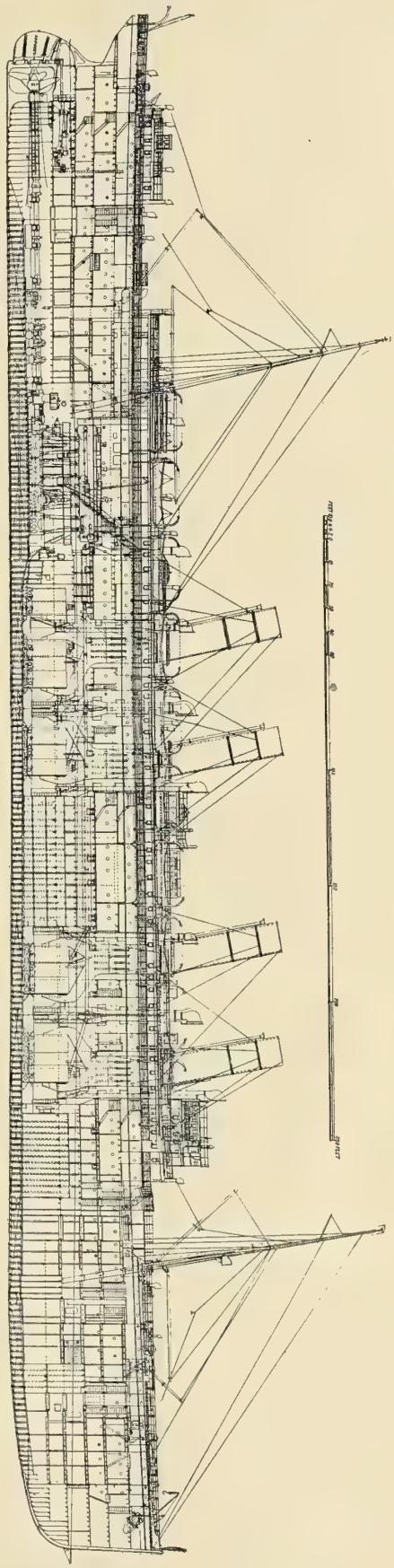
Several correspondents have written asking for additional information regarding the diagrams published in our December, 1897, issue, with the paper on screw propellers by Professor W. F. Durand, which was read at the recent meeting of the Society of Naval Architects and Marine Engineers. In this paper it will be remembered the author treats of the Influence of Surface on the Performance of Screw Propellers. We accordingly print here an index to the diagrams, which will be found useful in their interpretation.

Fig. 12. ..Propellor No. 2. } Upper curves: Work required at constant speed of 100 ft. per mt.
Fig. 13. .. " No. 3. }
Fig. 14. .. " No. 4. }
Fig. 15. .. " No. 6. } Lower curves: Thrust developed at constant speed of 100 ft. per mt.
Fig. 16. .. " No. 8. }
Fig. 17. Thrusts for constant speed of 100 ft. per mt., each curve for constant area as denoted by number.
Fig. 18. Work required for constant speed of 100 ft. per mt., each curve for constant area as denoted by number.
Fig. 19. Thrusts for constant revolutions of 100 per mt., each line for constant area as denoted by number.
Fig. 20. Work required for constant revolutions of 100 per mt., each line for constant area as denoted by number.
Fig. 21. Thrusts for varying surface at 100 revolutions per mt., each curve for constant slip as shown.
Fig. 22. Work required for varying surface at 100 revolutions per mt., each curve for constant slip as shown.
Fig. 23. Efficiency for varying slip, each curve for constant surface as denoted by number.
Fig. 24. Efficiency for varying surface, each curve for constant slip as shown.

The corresponding numbers will be found in the diagrams in the issue above referred to.

### North German Lloyd Liners.

In our issue of October, 1897, we published an extensive description of the new North German Lloyd liner Kaiser Wilhelm der Grosse, at the time of her maiden voyage across the Atlantic. We are now able to present a sectional drawing of this the largest steamship afloat, by reproduction from Engineering, London. To repeat the general dimensions of the liner, her length is 648 ft.; beam, 66 ft.; and depth, 43 ft., and her displacement ranging from 17,300 tons on 24 ft. draught to 20,880 tons on 28 ft. draught. She has accommodation for about 600 saloon passengers. The new ship building at Schichau's yard for the company, the "Kaiser Friedrich" will be completed in time for the summer traffic. She is 580 ft. long; 64 ft. beam; and 41 ft. deep. Her engines will develop 17,000 I. H. P.



LONGITUDINAL SECTION OF NORTH GERMAN LLOYD TWIN-SCREW TRANSATLANTIC LINER KAISER WILHELM DER GROSSE.

## HIGH PRESSURES AT SEA WITH SOME CONSIDERATION OF TYPES OF BOILERS.*—II.

BY W. R. CUMMINS.

Rankine is of opinion that the transmission of fire heat to water varies as the square of the difference of temperature between the fire and the water, and the experiments carried out by Mr. Blechynden apparently confirm this theory. Mr. Hudson, in a paper reviewing experiments on heat transmission, is of opinion that in all probability the difference of temperature between the two surfaces of a plate, transmitting the same quantity of heat, will be the same whether the transmitting medium be fire heat or steam heat, but that a much higher temperature of medium is required in the case of fire heat to keep up the temperature of the hotter side of the transmitting plate—that is to say, the internal resistance of the plate is the same whatever the transmitting medium may be.

This theory reconciles the apparently contradictory results obtained by experiments with fire heat and steam heat. Fig. 1 shows the results of one set of Mr. Blechynden's experiments on a plate of varying thickness. From it, it will be seen that for thicknesses, varying from 1-2 in. to 1 1-8 in., the transmission for any given difference of temperature varies approximately as the square root of the thickness. Below 1-2 in. thickness, however, the transmission varies apparently as some higher root of the thickness. It should be remembered that these experiments deal chiefly with the effects of radiant heat, and it may be that for convective heat the thinner plates may transmit heat varying as the square root of the thickness.

In Dr. Kirk's experiments, it will be remembered that with thick plates the heat transmission was so small that the plate next the fire became red-hot, the plate next the water being only 212 deg. Fah. From this it would appear that for plates above 1 1-8 in. say, the transmission would vary inversely as the thickness. Hence, in default of more experiments, we may assume in the meantime that the transmission varies as the square of the difference of temperature between the fire and the water, inversely as the thickness of the plate for thick plates, inversely as the square root of the thickness for moderate thicknesses, and inversely as the cube root of the thickness for thin plates. To estimate the effect of the increased temperature of the water due to the increase of pressure from 150 lb. to 250 lb., we may take the mean temperature of the gases in the boiler at 1,400 deg. Fah. The temperature of the water for 150 lb. pressure = 366 deg. Fah., and for 250 lb. = 406 deg. Fah. Then for the same thickness and condition of surface, we have:

$$\frac{(1400 - 406)^2}{(1100 - 366)^2} = .91$$

That is to say, owing to increased temperature of the water we should transmit only 91 per cent. of the heat transmitted under the lower pressure conditions; or, in other words, to transmit the same quantity of heat we would require 9 per cent more heating surface. With the same quantity of heat received we may expect an increase of steam economy of 18 per cent. Hence the higher pressure boiler, to develop the same power, should have 18 per cent less grate surface, but only 9 per cent less heating surface, than the lower pressure boiler, provided the thickness of the heating surface remains the same in both cases.

The importance of keeping down the cost and the space occupied by the higher pressure machinery has been insisted upon in the foregoing, and since the cost of the engines will certainly not be less, and the space occupied if four cranks are adopted may be more, then the whole of the saving must be made in the boiler space. This should be a very important factor in deciding

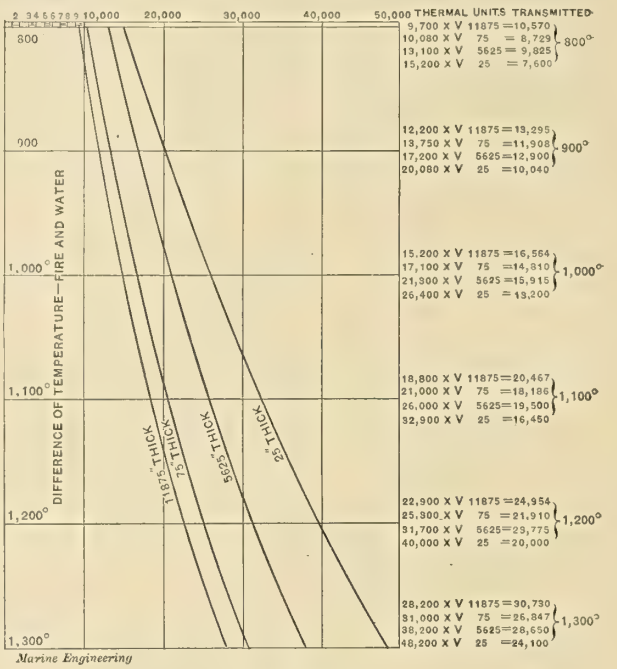



FIG. 1.

upon the best type of boiler for the increased pressure.

A satisfactory boiler for 250 lbs. working pressure suitable for the mercantile marine should have the following qualifications:

First—The design should be such that the pressure may be carried safely with the minimum thickness of the material forming the heating surfaces.

Second—It should have a large and free combustion chamber to allow the gases to combine properly before they lose any of their heat by contact with any of the heating surface.

Third.—After leaving the combustion chamber the gases should be split up into small streams and well distributed over the heating surface.

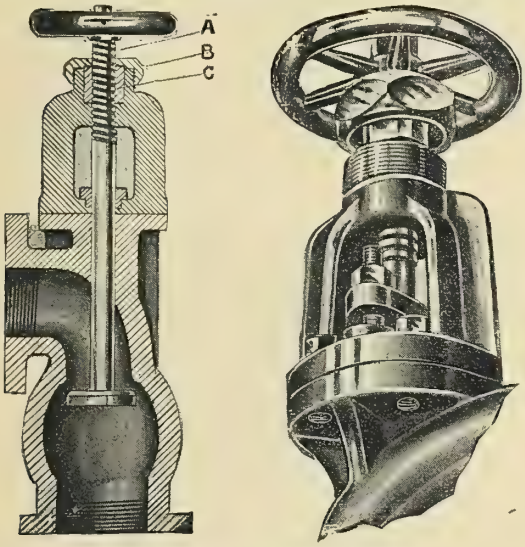
*(To be continued.)*

* From a paper read at the North-East Coast Institute of Engineers and Shipbuilders in Suhderland, England.

# IMPROVED APPARATUS.

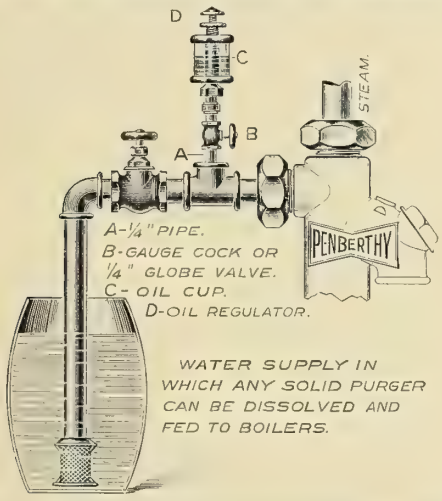
### Eclipse Blow-off Valve.

This valve is designed for use on high pressure boilers, and is so made that the stem can be repacked and the seat reground under pressure.




ECLIPSE BLOW-OFF VALVE.

The stem A passes through a nut B and brass screw bushing C held in place by the nut. When the valve needs regrinding the nut B is unscrewed and the wheel turned, causing the bushing to run up the stem, when the bushing is out




ARRANGEMENT FOR FEEDING BOILER "PURGER."

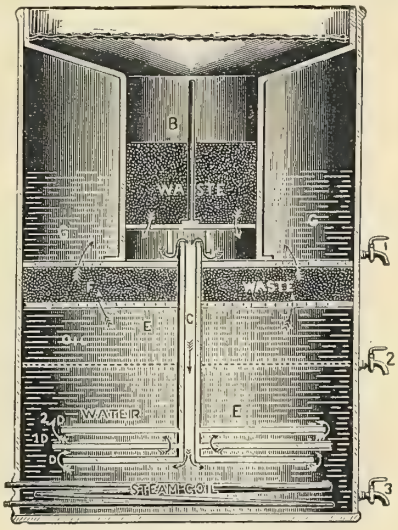
of its pocket the wheel and stem are turned until the face fits the seat tightly; the pressure in the boiler will keep the valve tightly closed during the operation. The John Davis Co., 61 Michigan St., Chicago, Ill., are the manufacturers of this valve.

### Boiler Compound Feeding Device.

An arrangement for feeding boiler compounds is here shown as adopted by the Penberthy Injector Co., of Detroit, Mich. The illustration shows it feeding from a barrel through an ejector into the boiler. The "purger" used is dissolved in the water contained in the barrel and then fed through the injector. The oil cup in position over the horizontal pipe is the arrangement adopted when using a liquid "purger," the rate of flow being regulated by the valve B. This arrangement is in use in the works of the company, and its design is not protected by any patents, but is given out by the company by way of helpful suggestion.

### Cross Engine Room Oil Filter.

A compact form of oil filter is shown in the sectional engraving herewith. The filtering medium in this is ordinary cotton waste which is placed in the receptacles marked. To operate the filter the steam coil is connected up and clean warm water is poured into the filter until it runs out of cock No. 2. Clean oil is then poured in on top of the water until it shows at cock No. 1. Then the filter is ready for use. The waste oil to be filtered is delivered into the filter at the top, where a wire grating collects any refuse mixed with the

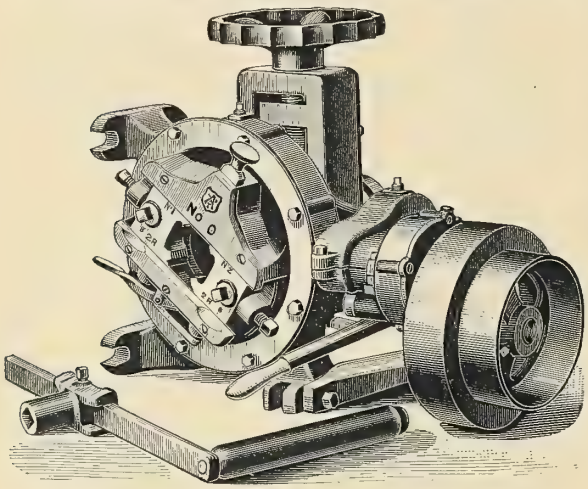



CROSS OIL FILTER.

oil, then the oil passes downward through the central vessel containing waste, where all the coarser impurities in suspension are collected. In this central vessel below the waste there is a chamber provided with baffle plate which causes a regular flow down the central pipe. From this pipe the oil passes into the surrounding heated water over the steam coil and then upward through a somewhat tortuous passage under and over the internal plates shown in the sketch, finally coming out into the body of the filter and up through the cross compartment filled with waste, which extracts any fine impurities which may yet be carried in the oil. It can be drawn off as required through cock No. 1. Cock No. 3 is used in washing out the filter. The filter is made in six convenient sizes, up to a capacity of 120 gallons a day, by the Burt Manufacturing Company, Akron, Ohio.

### Pipe Machines With Power Attachment.

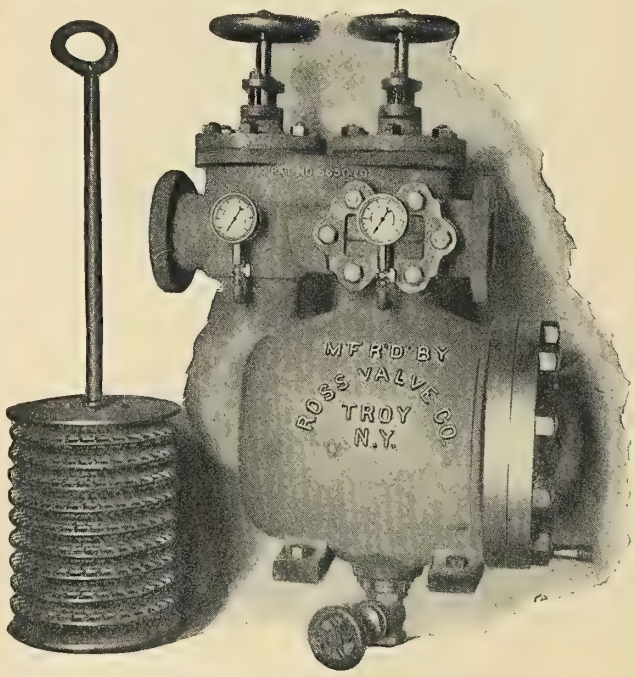
A demand for a "hand" pipe-threading machine fitted with a power attachment has caused the Armstrong Manufacturing Company to design and place on the market the machine here illustrated. This is known as their No. 0 machine with power attachment. The attachment is composed of an extra gear and pinion with a two-cone pulley which is slipped on the pinion of the second speed and has a stay bolted on the base to support it, making it perfectly strong. The engraving shows the machine with attachment for the belt. It is made for threading pipe 1-8 in. to 2 in., or bolts from 1-2 in. up to 1 1-2 in. All working parts are encased so as to keep them free from chips and dust. The gear of the die head does not bear on the head when revolving and therefore does not wear loose by friction. This is considered a very recent improvement on threading machines and makes it impossible for the operator to produce a "drunken" thread. Full particulars can be obtained by addressing the manufacturers, either in Bridgeport, Conn., or 139 Centre street, New York.



ARMSTRONG PIPE THREADING MACHINE.

### Feed Water Filter for Marine Boilers.

Accompanying engraving is the exterior view of a filter which has been introduced in marine work by the Ross Valve Co., of Troy, N. Y. It is constructed upon the patents of Railton & Campbell. The engraving shows the cage or filtering apparatus proper, removed and standing at the left of the filter. Upon the several segments of this cage are stretched a fibrous filtering material, and the cage is then placed horizontally in the body of the filter. The valve at the right works between an upper and a lower seat. When it is against the upper seat the feed water, entering at the inlet at the right, passes downward through the filtering material and out through the valve at the left. When the first valve is turned down to the bottom seat the water is by-passed directly to the outlet, and the other valve can be closed to keep it from backing downward through the filter. This valve can presumably be left open to allow the water to back through the filter for purposes of washing out. It will be noticed that the area of filtering surface presented to the action of the water is very large, and that by having a spare filtering chamber the material can be renewed when necessary with but a very brief interruption of the filtering action. The makers claim that the material can be used from one to three months, taken out, washed and used several times before being discarded, and that renewals, even when necessary are very inexpensive. The filtering area supplied varies from 150 to 1,000 times the area of the feed pipe, as may be desirable for the work in hand, and the water passes through the filtering medium with but little friction.

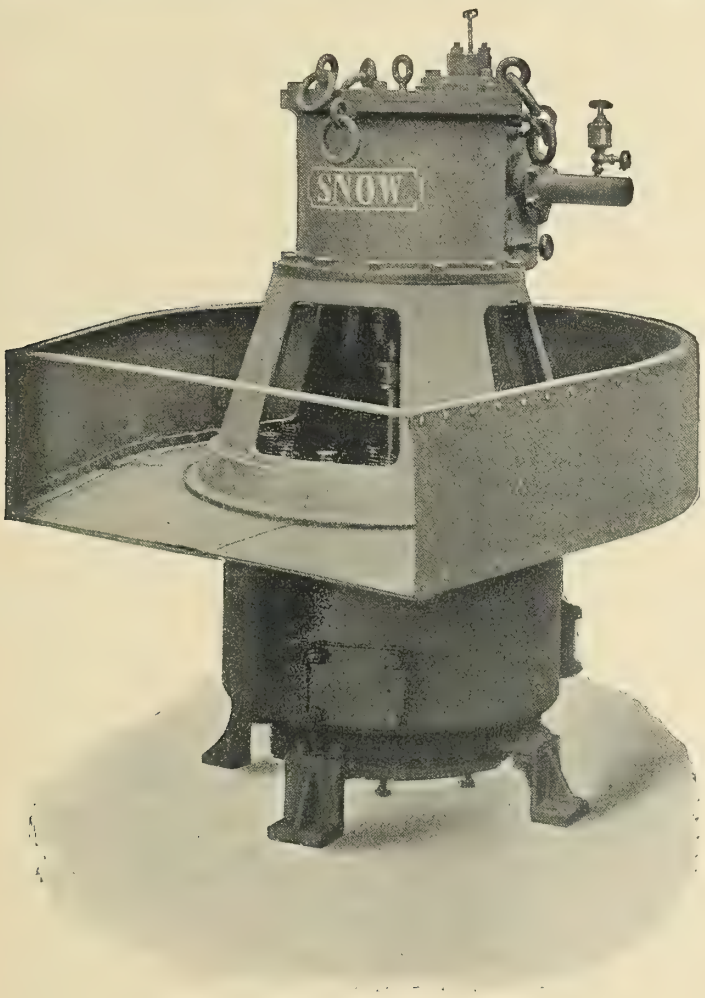



ROSS FEED WATER FILTER.

### Snow Steam Wrecking Pump.

The illustration herewith shows a new vertical wrecking pump built by the Snow Steam Pump Works for the Merritt Wrecking Co., of New York. It has been designed with three points in view, viz: That there should be no flimsy projections which might be easily broken off, that the pump should be light and yet highly serviceable when doing maximum work, and that it should occupy the least space consistent with accessibility and ease of operation. The pump rests on four stout feet bolted to the pump cylinder casting, the feet being provided with holes for bolting the pump to the supporting surface. Directly on the bottom the suction nozzle is placed, the diameter in this pump being 16 in. The suction valve deck is cast in the bottom of

the pump cylinder, made light and strongly ribbed to the cylinder barrel. In this deck the suction valve seats are screwed on a taper and have a bearing on the under side of a flange which is turned on the top of each seat, so that a gasket can be interposed between the seat flange and the deck, keeping the salt water from the threads. The valves are soft rubber, each covered with a brass plate, on top of which is the spring, so that an even bearing over the valve is secured. There are also valve guards in place. The pump contains eighteen suction and eighteen bucket valves giving a total water way through each set of 255 sq. in. or 35.5 per cent. of the bucket area. The bucket is cast iron, ribbed, and is lined on its periphery with brass, water grooved. It works in a heavy removable sleeve which is secured to the cylinder with bronze studs. The yoke between the steam and water cylinders is of cast iron made thus: A ring is cast around the upper edge of the pump cylinder and a corresponding recess is machined on the inside surface of the bottom end of the yoke, leaving an internally projecting ring around the bottom edge of the yoke. This ring and the ring around the top of the cylinder are cut away partially so that the remaining sections of the ring on the yoke pass through the cuts made in the ring on the cylinder. When so entered, the yoke can be turned around until the projections come opposite each other, and are then keyed vertically in place, the keys pulling the yoke down on conical surfaces machined on each. These center the yoke on the pump cylinder in such a manner that the yoke can be removed easily at any time by simply driving out the brass keys and tapping the yoke lightly. As an extra precaution against the loosening of the yoke they are bolted together by brass tap bolts which pass through clearance holes in the yoke and are tapped into the ring projections on the cylinder. The upper end of the yoke has an internal flange which is bolted to the steam cylinder and mechanically centered on a centering fit. The steam cylinder is of cast iron with the lower head cast in. A bushed valve chest is cast on the side of the cylinder and has double ports leading to each end of the cylinder arranged similarly to those on a duplex direct-acting pump, and having a cushion valve interrupting communication between the two ports at each end of the cylinder. These cushion valves when slightly opened cause the reciprocating parts to come to rest slowly and thus permit the valves to almost seat before reversal, thus permitting them to seat noiselessly at the reversal. With these cushion valves a much higher speed is said to be possible than on pumps which have not got them. The main distribution valve is of the piston type, fitted with spring rings. This piston valve is extended at both ends to form supplementary pistons by which the main valve is moved. The auxiliary valve is of the rotary type and is so designed that when it uncovers one chest port to the steam it uncovers the other to the exhaust, and causes the reversal of the main valve. The bonnet through which the auxiliary valve stem passes is turned in towards the center of the pump inside of the yoke. A lever attached to the end of the auxiliary stem carries the tappet rod which passes through a tappet block attached to the spool lever, which in turn is fulcrumed on the inside of the yoke. Thus when the spool which is keyed to the piston rod approaches its extreme positions, the spool lever block comes in contact with the tappets and causes the reversal of the main valve, thereby reversing the main piston. Pumps of this design are now made by the Snow Steam Pump Works, Buffalo, N. Y.




SNOW STEAM WRECKING PUMP.

# MARINE ENGINEERING

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IT has often been observed that individuals possess talents, which, though latent for many years, may suddenly become sensible under the stress of necessity or the opportunity of circumstance. We are reminded of this by reading the letter of Andrew Carnegie, recently published in the Iron Trade Review, and which will be found upon another page. This successful manufacturer had long been known as a capitalist, and philanthropist, and now he unexpectedly appears on the stage of publicity as a humorist. His humor smacks of the land of his birth, for it is indeed dry and deep, not apparent so much to the casual reader as to any one understanding the things of which he writes. His letter opens, in an odd mixture of philanthropy and humor with a call of attention to "the field which is open for a first-class shipbuilding yard upon the Hudson, East River, or lower bay near New York." It was surely the essence of great heartedness to call the attention of the poor benighted shipbuilders of New York to the opportunity which they wot not of. We can picture that grand old man of shipbuilding, William H. Webb, reading the paragraph with a snort, or the Roach interests eagerly jotting down the item in their note books, or perhaps Lewis Nixon smiling softly as he placed the letter in his safe. Mr. Carnegie is correct indeed that there is a field for a first-class yard near New York; yes, acres of them. But we are minded of the old picture puzzles which, to fit the case might read: Here is a first-class shipyard—find the ships? A shipyard without ships is just like a freighter without freight—it doesn't pay. But Mr. Carnegie gives specific reasons why New York is the best location for a shipyard. It could get repair work there, he says. It could if some one else did not get it away. The present facilities in New York are good for all repairs that the foreign ship owner is likely to have executed here. In fact we know of several shops which would like to see a considerable increase in the present amount of repair work, domestic or foreign, rather than any increase in facilities, which tend to cut down the profits that Mr. Carnegie refers to. Certainly he would not argue that the addition of another large competitive shop would increase profits. A dry dock as part of the equipment also would be in his opinion highly profitable. There is, surely need of a large dry dock in New York harbor, but the profit to be made out of it by private ownership is another question. There is probably a good profit in the present dry docks, for they are practically under one management. The addition of another commercial dock would mean either a division of profits, a cutting of prices, or a combine which would probably put prices above what the foreigner would pay. Now the third proposition of Mr. Carnegie is that steel, in the near future, will be carried from Pittsburg to New York for one dollar a ton, via the Erie Canal. We have not at hand the exact figures on freights to the various Atlantic coast yards, but there is little doubt that freight arrangements would speedily be made by the railroads for all points on the seaboard where yards are now located, which would offset any advantages the special route named offers. However, the fact is there are several men engaged in shipbuilding and marine engineering in and near New York whose judgment in such matters ought to weigh more than the opinion of any outsider. They would very speedily organize the necessary financial equipment for such a yard, but we are sorry to admit that in the present state of affairs such a yard is not needed. Even were the rightful amount of business being done in our seacoast yards would New York be a better point than a location further south? This is very doubtful. Land here would be much more valuable, and the cost of unskilled labor would be an addition of at least 100 per cent. in that item alone, besides the harbor facilities bear no com-

parison with what can be obtained elsewhere. Mr. Carnegie again displays his humor in the statement that, "seaboard yards are so usefully occupied with domestic business that they cannot give foreign business proper attention." This cannot be taken seriously. No doubt the coast builders are, many of them, very busy, but that they are unable to pay attention to prospective orders is not at all so. We were under the impression that there is a yard at Sparrows Point, as well located and equipped as any yard of its size anywhere, in which not an anvil has sounded for years. Or going further down the coast we find the yard on the James river with an equipment magnificent in every sense of the word; a yard indeed which has few equals the world over, and which could easily find room for half a dozen liners if a purchaser could be found. It was only the other day that the departure of Mr. Cramp, representing the Delaware river interests, for Europe with the avowed purpose of securing a share of the great Russian Naval appropriation was noted in the press. Supposing himself the owner of such a New York yard as he describes, Mr. Carnegie declares: "there would be no warships or Atlantic liners open for bids in any part of the world," that his yard would not have something to say about. Very true, but the shipyard might bid and possibly not get work. We believe Mr. Carnegie has had an experience of this sort with the United States Government in the matter of armor plate. Apart from the question of location there are serious statements in Mr. Carnegie's letter regarding the possibility of this country resuming its rightful position as a maritime nation, and a builder of ships. What has happened in the steel rail, the locomotive, and the bridge business, for examples, will just as surely come in the shipbuilding line. It has not come yet, however, and the efforts of those who have the interests of this branch of trade at heart would do more good in extending the operations of those already in the business rather than in causing the investment of capital in disappointing schemes. Mr. Carnegie has grown rich under a system of protection, which does not exist for the shipowner in the foreign trade. We expect to see the day when the present number of yards will be increased many fold, but before this comes there will have to be adopted by the Government such measures as will induce American capital to invest in the ownership and management of steam vessels. A yard started to build ships for foreigners only would be a perilous venture, for the backbone of any nation's yards is that nation's vessels.

OUR English contemporaries announce that the Hon. Charles Parsons has designed a new form of steam turbine which he is able to reverse. The ability to go astern in the new turbine is secured by a valve arrangement whereby the live steam may be made to flow in either direction, with a necessary modification in the shape of the blades. In the "Turbinia" there was power enough to drive the vessel at 32 knots ahead and only 10 knots astern. Some were of the opinion that 10 knots speed astern was sufficient. That depends! Suppose two vessels approaching a common point and that before reaching this, even for an infinitesimally small distance, both should go astern, even at the rate of two knots, it is manifest a collision could not occur. A speed of 30 knots astern would not make the collision less possible. The elements of time and distance, however, are of vital importance to the practical navigator. In a fog, or emergency, the promptness with which ahead motion of the vessel could be changed to astern is everything. Experiment has proved this change of direction cannot be made in less distance than four or five lengths from the moment of the reversal of the engines, provided, too, that as much power is available for the astern as the ahead motion, and this is irrespective of the speed at which the vessel is moving. The efficiency astern would be less than the ahead. The time of reversal of motion would, of course, depend upon the speed at which the vessel was moving. A vessel is able to stop and gather sternway when going full speed ahead quicker than it can attain full speed ahead from a condition of rest. Ahead the hydraulic resistance alone opposes its motion, while, when the direction is reversed, this resistance is additional to the sternward propulsive power. With less power for going astern than ahead, such as in the "Turbinia," or with more, as in the case of, say, an Atlantic liner going half-speed ahead, the results would be correspondingly changed. It will thus be seen that it is very necessary to have at least as much power to go astern as ahead, if you want to stop quickly. The "Turbinia," in addition to being handicapped in manoeuvring capability, was obliged to carry an independent reversing turbine; a dead weight going ahead.

### Andrew Carnegie on the Shipbuilding Industry of the United States.

Writing from Cannes, France, Andrew Carnegie, the steel maker, expresses his views regarding the United States shipbuilding industry in a letter to the "Iron Trade Review," of Cleveland, thus:

"May I call attention, through your columns, to the field which is open for a first-class shipbuilding yard upon the Hudson, East river or lower bay, near New York?

"The prices paid for steel by British and German shipyards are so much higher than shipbuilders in New York would be required to pay that the difference would make, in itself, an excellent profit. Plates are worth about $22 or $23 a ton in New York. The quoted price at Glasgow is nearly $30. Other prices are in proportion, and all the woodwork of ships is also much cheaper with us. If a yard were built today with the newest appliances, the total cost of labor, even at much higher wages, would be less than in any shipyard I know of, either in Great Britain or Germany.

"I name near New York as the best for several reasons:

"First. A shipyard there would get repair work, which is always profitable.

"Second. A drydock could be part of the equipment, which would also be highly profitable.

"Third. Two years hence the cost of transport upon steel delivered at the shipyard at New York from Pittsburg, the cheapest market for steel in the world, will not exceed $1 a ton, via Conneaut and the deepened Erie Canal.

"Indeed, it will be less, since it will cost nothing to send steel to Conneaut in cars which otherwise must return to the lake empty for ore. The present seaboard shipyards are so usefully occupied with domestic business that they cannot give foreign business proper attention. The New York yard should be constructed on a larger scale and with special reference to the foreign demand.

"I am satisfied that the United States can readily regain the supremacy in shipbuilding it had when wooden ships were in vogue. It only needs an enterprising western shipbuilding concern to establish a yard near New York and manage it with the skill and energy which have characterized those on the lakes. This is the only prominent department of manufacturing in which our country is behind, and it is one in which it easily can obtain front rank. It would justify steel manufacturers to guarantee to such a shipbuilding concern a continuance of the present extremely low rates upon steel for a term of years, and also that steel of all kinds and armor and guns should always be furnished at the lowest price paid by European shipbuilders. But there is nothing to fear from the prices of steel, for these henceforth are to rule lower in our country than in any country of Europe. It will not be long before a large portion of its steel supply must be drawn by Europe from the United States.

"If I were a younger man, or rather, if I did not belong to a concern so enterprising as to employ all my capital and give me a pleasurable occupation watching over its progress and success, I should be greatly inclined to enter upon the building of ships somewhere near New York harbor. There would be no warships or Atlantic liners open for bids in any part of the world which the New York yard would not have something to say about. Every needed element is present for regaining our supremacy as the principal shipbuilding country. Surely some one of the successful lake concerns will consider the advisability of establishing a branch yard near New York—a branch which I predict would very soon grow to many times the capacity of the original works, and give a much higher return upon capital, besides rendering its originator famous. ANDREW CARNEGIE."

## MISHAPS AT SEA.

### Salvage Work on the S.S. Rosedale.

An exceedingly skilful salvage job was successfully undertaken in the case of the Lake steamer Rosedale. Her dimensions are: Length over all, 254 ft.; beam, 35 ft., and depth, 21 ft., with a gross tonnage of 1,507 tons.

She was bound down Lake Ontario with a cargo of 65,000 bushels of wheat from Fort William to Prescott, when she stranded on the Charity shoal. Wrecking outfits were at once sent to the vessel and with the aid of powerful pumps she was floated off the shoal. She commenced to fill rapidly, however, and it was considered best to tow her back onto the shoal rather than take chances of her sinking in deep water. Later, work on the vessel was stopped as the underwriters believed it would not be possible to get her afloat. The Donnelly Salvage and Wrecking Co. of Kingston, Ont., then got permission from the various insurance companies to attempt to save the vessel. This company loaded its tools and coal on a schooner and got to the wreck at midnight on Sunday, December 12. Eight pumps were put aboard the Rosedale including three grain pumps to throw out the wet cargo. These pumps were connected up to the boilers on the schooner and kept continuously at work.

The Rosedale drew 16 ft. when loaded, and when on the shoal she drew 17 ft. forward and 13 ft. aft. She was fitted with a water bottom 3 ft. deep, and in many places the bottom was forced up through the inside tank tops, as the shoal was covered with boulders. One of the rents was 40 ft. long, though not very wide. A gale of wind and heavy sea interfered considerably with the work, but by Tuesday the grain was pretty well cleared away from the tank tops. Bags filled with cement were then sent down by divers and laid athwartships over the rents in the tank tops, and over these bags 2 in. wooden platforms were laid and shored down from the deck above. The lengths for the shores were found by the divers by using movable wooden battens. Scrap iron was used to sink the platforms in position. Meanwhile the engine and boiler rooms of the vessel were pumped out and steam raised in her boilers, and all the steam pumps taken aboard were set at work. On Wednesday evening the Rosedale floated and was towed 15 miles and then allowed to sink on Hinchley's flats, opposite to Cape Vincent, so that the wreckers, who had been at work without intermission even for sleep for five days, were enabled to take a needed rest. The following day she was towed to Kingston. An examination in dry dock showed that for over 200 ft. her outside bottom was all gone and the inner bottom was broken through in 33 places. The estimate of damage was $35,000.

The Rosedale was built in 1888 at Sunderland, England, for the St. Lawrence and Chicago Shipping Co. She was insured through Buffalo parties for $75,000 and the cargo had been insured in Chicago for $66,000. The engraving shows her arrival at Kingston in charge of the wrecking crew.

### Shaft Breakages en Voyage.

Cases of broken shafts have been unusually numerous of late in the Atlantic trade. These have not been confined to tramps or vessels in poor condition, but several recent mishaps occurred to as fine vessels as are in the transatlantic trade.

The French liner La Champagne broke her shaft when out five days from Havre, and after drifting about for days she was sighted by the Warren Line steamship Roman, and taken in tow, reaching Halifax on February 27. After the mishap and when the engineers of the "La Champagne" had reported there was no possibility of effecting any repairs a boat's crew left the vessel to get in the track of vessels and

report the breakdown. This boat was in charge of Officer George Unsworth, and after several days of suffering and exposure, it was picked up by the Holland-America liner Rotterdam, bound for New York. The "La Champagne" had a large passenger list.

The American liner Paris, which sailed from New York for Southampton March 2, broke her starboard outboard shaft when out about 24 hours. There was fair weather and smooth seas, and with the port propeller alone the "Paris" made good headway, her daily runs ranging from 280 to 315 knots. The engines of the "Paris" are fitted with controlling gear which automatically slows down the engines when the speed rises above the normal, and this gear effectually prevented damage to the engines when the break occurred. The shaft was a new one of nickel steel, which had only recently been fitted to the vessel. The breakdown caused the liner to miss a trip.

A tow of 1,000 miles was successfully accomplished by the oil tank steamer Duffield which picked up the freight steamer Osborne in mid-ocean March 14. Two days before, the "Osborne" broke her tail shaft. She was on a voyage from London to Philadelphia under charter to the Atlantic Transport line with a general cargo. The "Duffield" was also bound west on the same course. When the "Duffield" agreed to tow the disabled steamer it was decided to try and reach Philadelphia, but bad weather caused the masters to steer for Halifax, which was reached March 20.

On March 7 the Cunard liner Catalonia, on the Boston route, was towed into Halifax by the oil tank steamer Delaware. She had left Queenstown February 23 for Boston, and when about six days out her crank shaft broke and she was helpless. For about two days she was adrift, until the tank steamer Delaware sighted her and towed her about 500 miles to Halifax. There were eighty-five passengers on the Cunarder.

The German steamer Marie Rickmers, bound from Bremen for Baltimore, was picked up at sea last month by the steamer Alpha and towed to Halifax. The breaking of the propeller shaft disabled the "Marie Rickmers." She is a new steamer of about 4,500 tons.

LAKE STEAMER ROSEDALE REACHING PORT AFTER THE STRANDING ON CHARITY SHOAL.

### Destructive Fires on Vessels.

On the arrival of the steamer Flowergate at Boston February 27, with the passengers and part of the crew of the British steamer Legislator, a fearful story of fire at sea was related. The "Legislator" had left Liverpool for Central American ports on February 13, with a mixed cargo containing a lot of chemicals. When about 700 miles west of the Azores an explosion, followed by an outburst of flames, occurred in the forehold. The flames spread very rapidly, consuming all the woodwork in the forward part of the vessel and only stopping at the fire room bulkhead. Attempts were made by some of the crew to get out the boats, but this resulted only in the loss of several lives, as a tremendous sea was running. After about three days, during which the fire continued to burn in the holds, the "Flowergate" came up and took off those on board the "Legislator" in her boats. Many of them had been severely burned, though they had had medical attention from a Dr. Gordon Mortimer who, with his wife, were passengers aboard the burned ship. The "Legislator" is supposed to have sunk soon after she was abandoned.

Fire destroyed the Memphis and Vicksburg Packet City of Savannah while she was at her Memphis landing March 9. When the fire started the boat was about to leave with a large cargo and several passengers. The flames were first noticed on the upper deck in the vicinity of the smoke pipes. Several companies of the city fire department responded and the vessel was speedily flooded with water and sank to the bottom, but not before her upper works were destroyed. The vessel was about eight years old, having been built at Howard's Ship Yard at Jeffersonville, Ind. She was a stern wheeler, 190 ft. long; 32 ft. beam, and with 5 1-2 ft. depth of hold. She was valued at $25,000, and insured for $14,000.

# EDUCATIONAL.

## ELECTRICITY ON BOARD SHIP, PRINCIPLES AND PRACTICE.—VIII.

BY WM. BAXTER, JR.

In the diagrams of motors, Figs. 27 to 33, three different kinds of armatures are shown; the ring, the disc and the drum. The principle of winding is the same in all of them, although judging by outward appearances there would seem to be no similarity between the ring and the drum winding. The object sought after in each case is to so arrange the wire and the connections between it and the commutator that at all times the current will flow in the same direction through all the wires on each half of the surface of the armature presented to the opposite pole faces, but the direction in one-half to be opposed to that in the other; that is, if on the side facing the N pole the current flows to the commutator end, on the side facing the S pole it must flow away from the commutator end. The manner in which this is accomplished in the ring armature has already been

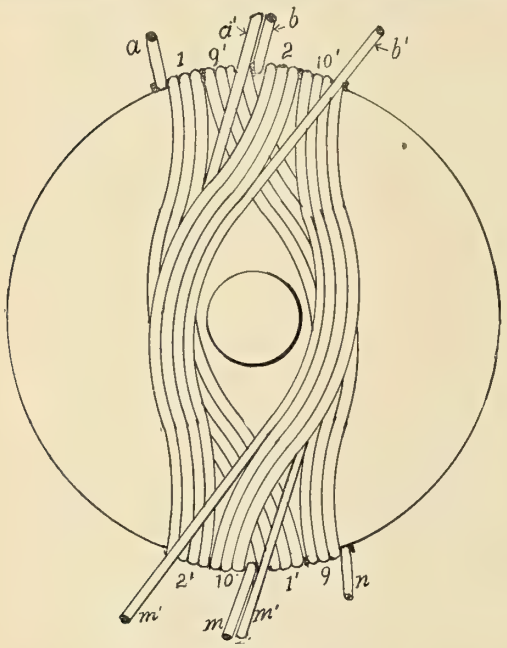



FIG. 42.

explained, and Fig. 40, an illustration of a ring armature, will help to make this matter more clear. This cut shows the back end of the armature and thus clearly reveals the manner in which the wire is wound around the rim of the ring. The surface of the armature is divided into as many parts as there are segments in the commutator, and in each one of these divisions a certain number of turns of wire is wound, the number depending upon the size of the machine, the pressure it is to develop, etc. The ends of the adjoining sections of wire, or coils, as they are called, are united, and connected with a commutator segment, thus the effect is the same as if the whole armature were wound with a single piece of wire with loops carried out at the turns that form the terminals of the coils, and these loops were connected with the commutator segments. It is evident that with such a winding if the commutator brushes rest on opposite sides of the commutator on a diameter at right angles to the center line through the pole pieces that the current on entering the armature will divide, one-half following each half of the ring and coming together at the opposite side. It is also evident that these two currents will traverse the halves of the wire opposite the pole faces, and that on each side the direction of the current in every turn of wire will be the same, and that the current as a whole will flow in opposite directions on the two sides of the armature.

In the disc armature the winding is the same as in the ring, the only difference between these two styles of armature being in the shape of the core. The drum winding, however, has to be somewhat modified owing to the fact that as there is no open space through the center of the armature, a place must be found upon the outside surface for that part of the

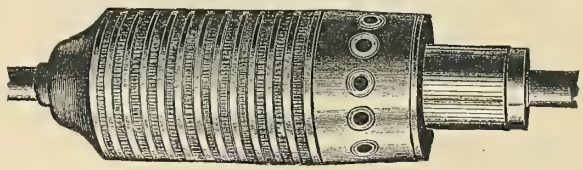


FIG. 41.

coils that in the ring passes along the inner surface of the rim. Fig. 41 shows the general appearance of a drum armature, and Fig. 42 will help to make clear the manner in which the coils are wound and connected with the commutator. As in this type of armature, both sides of the coil have to be placed upon the outer surface, the commutator segments cover twice as long an arc for the same width of coil as in the ring, and this has led many students to suppose that the number of divisions of the commutator is reduced to one-half; but such is not the case, for although the widening of the commutator segments reduces their number to one-half the armature coils are also reduced to one-half owing to the fact that each coil occupies two positions on the outer surface. This can readily be understood from Fig. 42, in which coil 1 occupies its full width on opposite sides of the circumference, and this is also the case with coil 2 and coils 9 and 10. The part of coil 1 on the upper side of the figure may be regarded as corresponding to the part of a coil in a ring armature that fills a position on the outside of the rim, and may be called the front of the coil. In the same way the part filling the position marked 1′ may be called the back of the coil, and corresponds to the part that passes through the center of the ring armature. The part marked 9′ is the back of coil 9 and in the ring would pass along the inner surface of the rim, the same as side 1′ of 1. Coil 2 is separated from 1 by 9′, but as 9′ fills this space because there is no other position for it, 2 can be regarded as the coil that adjoins 1 just as much as two coils side by side in the ring armature. If end a′ of coil 1 is connected with end b of coil 2 the relation of the two coils will be the same as in the ring winding. If the

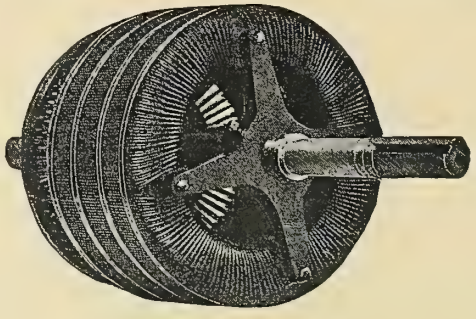


FIG. 40.

armature were completely wound coil 3 would adjoin 10′ and would be followed by 11′ and then 4, and so on around to 9. If a current were passed into the wires a′ b it would follow through to a′ on one side and b′ on the other, and if all the coils were wound

and connected with each other in the manner just described the path from b′ would be through coils 3, 4, 5, 6, 7, 8, 9 to wire n′, and from wire a′ through all the remaining coils to wire m. Thus it will be seen that in all the coils to the right of wires a′ b′ and n′ m the direction of the current would be the

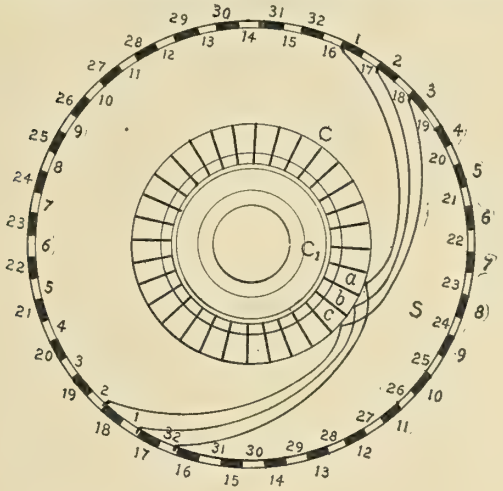



FIG. 43.

same, and that this would also be true of all the coils to the left, but on (the) two side the direction of current would be opposite.

In Fig. 42 the two ends of the coils are shown coming out on the same side of the armature, this being done because it simplifies the winding, specially the connection of the ends with the commutator. This is the almost universal practice, but sometimes the ends are brought out on the opposite sides. When the latter course is followed it is for the purpose of changing the position of the brushes upon the commutator. With the simple winding of figure 42 the brushes have to be placed at positions midway between the poles, that is, if the ends of the coils are connected with commutator segments directly in line with them, which is the universal custom. Sometimes the shape of the machine is such that if the brushes are placed opposite the interpolar spaces they cannot be got at very easily, and then it becomes desirable to change their position. This can only be

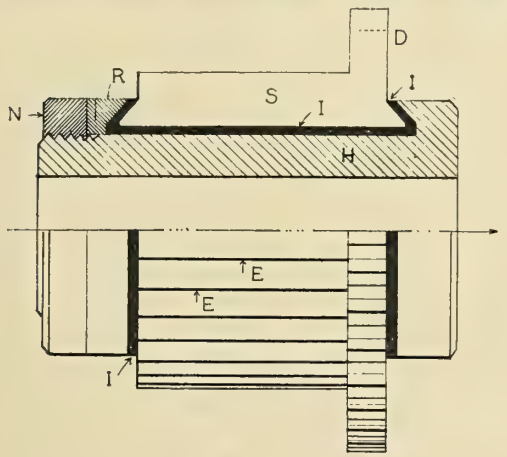



FIG. 44.

accomplished by connecting the wires with segments not in line with them. When this is done it is not advisable to carry the end coming from the back of the coil across to the opposite side of the armature, for from this position it would have to be carried back again; it is, therefore, better to resort to the arrangement shown in Fig. 43. If this figure were wound with both ends of the coil coming out on the same side as in Fig. 42, the junction of wires a′ and b of coils 1 and 2 would be connected with segment n of the commutator C, but as the object is to shift the connection around the circle to segment b, a considerable amount of wire can be saved by running the end a′ of coil 1 from the lower side of the armature to segment b, and the end b of coil 2 from the upper side to the same segment. All the other connections are made in the same order, and as a result when the commutator is fully connected the wires leading from it to the armature coils are twisted around in a manner that appears quite confusing to a novice, but from a study of these two figures it will be found that it is not in the least complicated.

The most prominent machine in which the connection of Fig. 43 is used is the Edison. The only thing to guard against in connecting such armatures is to not get hold of the wrong ends. In the ordinary winding of Fig. 42 such mistakes cannot very well be made as the ends that are to connect with the same commutator segment are side by side and cannot easily be displaced. In Fig. 43 the front sides of the coils are made black and the backs white so as to show the method of connection more clearly. For the same reason the front sides are numbered on the outside of the circle and the backs on the inside. To find

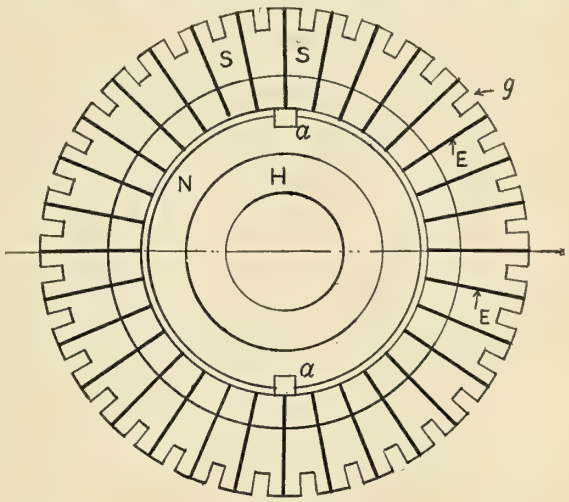



FIG. 45.

the two ends of each coil in an armature that is to be connected in this manner the best course to pursue is to connect one end with a battery having in circuit with it a bell, then the other end of the wire is connected with the ends on the opposite side of the armature until one is found through which the bell will ring, and this is the other end of the coil. After the ends are found they should be numbered, and when they are all numbered the connection will be very simple.

To avoid confusion it may be well to say that in Fig. 42 the number of coils is 16 and in Fig. 43 it is 32.

Figs. 44 and 45 show the construction of the commutator, the first being a side view, with the upper half in section, and the last an end view. The segments are marked S and as will be seen they are held in place, on the hub H, by means of the nut N and ring R. In addition to being securely held they are metallically separated, or insulated from each other, and from the hub, by the insulations I and E shown in black. This insulation is generally made of mica, as this material is a very good electric insulator and is also strong mechanically. The ring R is provided so that when the nut N is turned around it will not drag the segments out of place. R is held by a feather so that it cannot revolve. The nut N

is sometimes made with flat faces, on opposite sides, so that it may be turned by a wrench and sometimes with slots, as shown at aa, in which the end of a spanner may engage. The ends of the wire coils of the armature are fastened to the part D, as a rule, being soldered into grooves shown at g in Fig. 45. but they are also secured by means of screws. Either method is good with good workmanship, but both are bad with poor workmanship.

## QUERIES AND ANSWERS.

If J. W. B. and O. R. will send their full names and addresses their queries will receive attention. All communications in this department of Marine Engineering are considered confidential, and any correspondent who fails to send his correct name and address with a question need not expect any consideration.

Q.—H. D. B. California.

A.—You will find the data concerning the battleships of the United States Navy on Page 15 of our March issue, and the data concerning foreign navies you ask for on Page 17 of our May, 1897, issue.

Q.—Should the water be fed into a Scotch boiler in the steam or water space? T. P.

A.—Into the water space below the water line. If you feed it into the steam space the chances are the greater part of it will be carried over into the engines. The correct point at which to admit the feed is a matter about which differences of opinion exist. A distributing pipe fitted above the waterline is likely to be shattered in a very short time if the feed is intermittent.

Q.—What is meant by the co-efficient of fineness of a vessel? J. F. C.

A.—The fractional part which the volume of the immersed portion of a vessel bears to the volume of a rectangular block of the same length, breadth and depth. The formula reads:

$$\text{Co-efficient of fineness} = \frac{D \times 35}{L \times B \times W},$$

D being the displacement of the vessel in tons of 35 cubic feet of sea water to the ton; L, the length between perpendiculars in feet; B, the extreme breadth of beam in feet; and W, the mean draught in feet, less the depth of keel, if the vessel is fitted with an outside keel. Fast ships with fine lines have a co-efficient of fineness of about .55, ordinary merchant steamers .68, and slow freight vessels about 75.

Q.—What is the best material for a screw propeller? W.

A.—That depends on a number of conditions, and as you do not give details, only a general reply can be given. Cast iron is cheaper than other materials and can be more readily obtained. It is easily machined, but such propellers are heavy and cumbrous. An advantage of this material is that should the propeller come in contact with a dock wall or other immovable body, the blades will break and prevent serious damage to the propelling machinery. Steel or bronze would only twist out of shape. Cast iron and steel propellers, of course, are liable to severe corrosion, while manganese bronze is not so affected. Bronze propellers are also made with very thin accurately shaped blades giving increased efficiency.

The Old Dominion line has under consideration the construction of a new steamer upon the lines of the "Princess Anne," which has proved herself to be a remarkably fine and economical boat.

The side wheel steamboat Grand Republic, said to be the largest on the Mississippi River, was burned to the water's edge while in winter quarters near the mouth of the River des Peres, March 13. The captain and his party were aboard asleep when the fire broke out in the galley, and the flames spread so rapidly that they had difficulty in getting ashore without injury. The vessel was built in 1878 at Pittsburg, and cost about $100,000. She belonged originally to the Helena and New Orleans Transportation Company, and was used for carrying cotton. For several years, however, she had been used exclusively for the excursion trade, having a license to carry 3,500 passengers. Her dimensions were: Length, 265 ft.; beam, 50 ft. She had four decks. She was owned by the Columbia Excursion Co., and was insured for $30,000.

## ENGINEERS' DICTIONARY.—IV.

**Bilge Pump.**—A pump for the special purpose of freeing the bilge of water. In some cases such pumps are attached to the main engine, but more commonly in modern practice they are independent and are used only as needed.

**Blow down** or *blow off* (to).—A verb signifying the operation of discharging water from the boiler through the bottom or surface blow.

**Blow through** (to).—A verb signifying the operation of driving all air and water out of a steam cylinder and of heating it to the working temperature by allowing steam from the boiler to blow through the throttle into the cylinder, and out through the relief valves or drains.

**Boiler.**—In the general sense, any receptacle in which steam is generated by the application of heat. To this end a boiler must contain three fundamental features: A place for the fire, a place for the water and a partition between them. The great variety of boilers arises from the different forms which these features take, and the different manner in which they are arranged. The keynote of the development of steam boilers from the earliest forms is contained in the word *sub-division*; sub-division of the hot gases and of the water, so that no particle of either shall be very far from the partition or *heating-surface*. If in addition to this sub-division, provision is made for a definite flow of the hot gas along one side of the heating surface and of the water along the other in the opposite direction, the conditions for the most efficient transfer of the heat of the former through the surface into the latter will be fulfilled. In modern boilers the principle of sub-division has been carried to a high degree of development, but the conditions for proper circulation are but imperfectly fulfilled. The sub-division is obtained by the use of a large number of tubes or tubular elements surrounded by a shell or casing. The first and chief classification of the general term *boiler* is made according to the relation of the water and hot gas to these tubular elements. If the gas is led through the inside and the water is on the outside, the arrangement is known as a *fire-tube* boiler. If, on the contrary, the gas is on the outside and the water circulates through the inside, the arrangement constitutes a *water-tube* boiler. Of the great variety of boilers in use we shall here only refer to a few cases typical of marine practice.

RETURN FIRE TUBULAR OR SCOTCH BOILER.

Fig. 6. This consists essentially of an all inclusive cylindrical steel *shell* containing one or more cylindrical *furnaces*, usually corrugated circumferentially for strength, opening into *combustion chambers* at the back end, from which a large number of small *tubes* lead again to the front end or *head* of the boiler. The *grates* are placed at about the center of the height of the furnace, and the fire and hot gases occupy the upper part of the furnaces, the combustion chambers, and the inside of the tubes, while the water and steam fill all remaining parts of the shell, the water level being usually some 6 in. to 8 in. above the highest part of the tubes or combustion chambers. The hot gases pass from the fire on the grate bars into the combustion chamber, thence forward through the tubes and out through the *uptake* or *front-connection* to the *smoke stack* or *funnel*. Several varieties of this boiler are in common use. Thus the number of furnaces may be one, two, three, or four. They may be fitted with separate combustion chambers, or there may be one combustion chamber for all furnaces, or as is common with four furnaces, there may be two combustion chambers, one for the two furnaces on either side. Again, the boilers may be *single-ended* or *double-ended*. Fig. 6 is an example of the first. A

double-ended boiler consists of two sets of furnaces opening from either end of a shell of double length. It is evidently equivalent to a pair of single-ended boilers placed back to back, the back heads removed and the shells joined. Such boilers may also have either separate combustion chambers for each end, or a common combustion chamber for both ends. The former arrangement is to be preferred, and becomes necessary where forced draft is used.

DIRECT FIRE TUBULAR OR MODIFIED LOCOMOTIVE TYPE.

In this boiler the hot gases pass from the grates, either direct or through a combustion chamber, to the

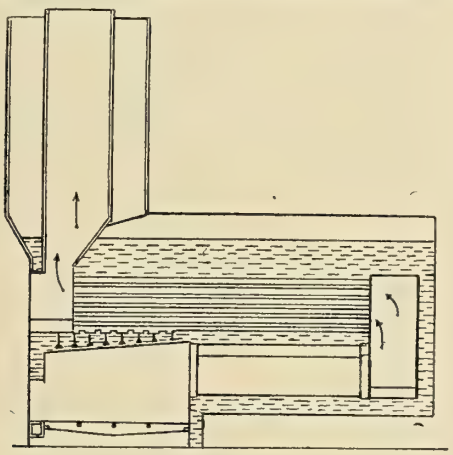


FIG. 7.

tubes which lead on to the farther end instead of back to the front. At the farther extremity is a connection or smoke box which leads to the stack. In such cases the boiler for the same power is of smaller diameter and greater length than the Scotch type, and it is readily seen that the whole arrangement is simply a mode of exchanging diameter for length. Boilers of this type, with a combustion chamber between the furnace and tube plate, are sometimes used where head room is very restricted, as on light draft gunboats or other small craft, while

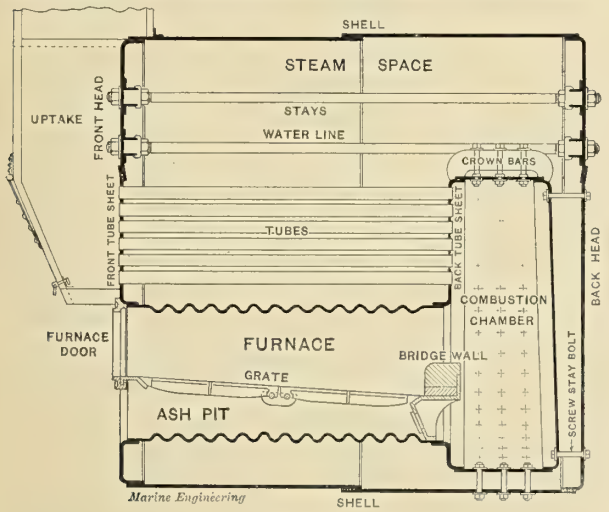



FIG. 6.

boilers of the more simple type without the combustion chamber are not infrequently met with on tugs and river craft.

FLUE AND RETURN TUBULAR OR "LEG" BOILER.

Fig. 7. In this boiler the hot gases pass from the grate through large tubes or *flues*, as they are termed, to a combustion chamber at the farther end. They then return to the front through small tubes and are led by an appropriate uptake to the stack. The furnace is of rectangular cross-section, and the front end of the boiler is modified on the sides and bottom to correspond to this form. The boiler shell surrounds the furnace on the sides leaving a narrow space between the two known as a *water leg*, whence the common name of the boiler. This form of the front end of the boiler with flat sides and rounded top is sometimes known as a *wagon top*. The remainder of the shell is known as the *barrel*. Very commonly, as shown in Fig. 7, an attachment to the shell known as a *steam chimney* surrounds the lower part of the stack, the office of which is to subject the steam to the drying and superheating effects of the gases on their way through this part of the stack. Such boilers have been much used on tug and river boats.

WATER TUBE BOILERS.

Turning now to this type, a brief mention only can be made of some of the characteristic features which are combined in the greatest imaginable variety, making possible the vast number of forms of such boilers on the market at the present time. In the engravings here shown Figs. 8, 9, 10, 11, a few typical forms are introduced to aid the description of the characteristic features. The number of actual varieties is so great as to render impracticable any comprehensive pictorial representation. Most boilers of this type have one or more cylindrical drums or chambers on top and one or more similar chambers below, the two sets of chambers being connected by sets of tubes. The feed usually enters first the upper chamber, frequently passing on its way through a coil heater in the base of the stack or top of the

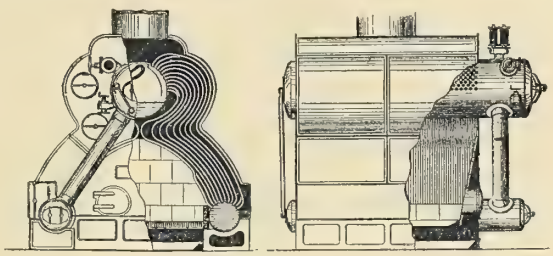


FIG. 8.

boiler. It then flows down certain of the tubes to the lower chambers. If these tubes are of extra large size and specially intended for down flow, the boiler is said to have special *down flow* or *down cast tubes* or *pipes*, as in all of those here shown. In some cases such tubes are omitted, and the feed must descend through part of the small inner tubes. In any case it then enters the lower end of the *up flow* or steam forming tubes which are surrounded by the hot gases coming from the furnace below them. During the passage of the water upwards it is partly converted into steam, and the mixture issues from the upper end of the tubes into the upper chamber. There the steam is separated and led to the engine, while the water joins that already in this chamber, and thus begins another round. In some cases the upper ends of the steam forming or delivery tubes are below the level of the water in the upper chamber, and they are then said to be *drowned* or *wet*. In other cases they are above the water level, and are said to be *dry*. In still other forms they enter at about the middle of the chamber or about the water level, and may be *wet* or *dry*, as the level varies. Figs. 8 and 9 have *dry* tubes, while in Figs. 10 and 11 the opening is near the water level. Again the tubular elements may be made in a great variety of forms. In some they are straight as in Fig. 11, in others curved as in Figs. 8, 9 and 10. In some they are continuous between chambers as in Figs. 8 and 9, while in others as Figs. 10 and 11, they are made up of lengths or of different parts with screwed

joints, elbows, returns, junction boxes, etc. In some they are expanded into the shells of the chambers, in others screwed. In some all joints are carefully protected from the direct action of the flame, in others screwed joints are freely exposed to the flame. In

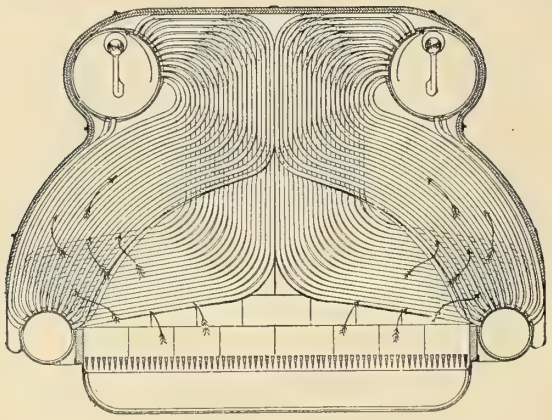


Fig. 9.

some the general direction of the tubes is nearly vertical, in others nearly horizontal, and in others bent or curved in various forms. In some types, as Fig. 11, the lower chambers are omitted, or consist merely of the lower portions of the tubes and *headers*, or members to which they are connected. In all cases the grate lies below the tubes and frequently between the lower chambers, as Figs. 8 and 9, while the whole is surrounded by a casing intended to prevent, so far as possible, the loss of heat by radiation.

RESUME:

The weight of Scotch boilers without water per square foot of heating surface is usually from 25 to 30 lbs.; of water tube boilers of the lighter types from 12 to 20 lbs. The weight of the contained water per square foot of heating surface is usually found respectively from 12 to 15 lbs., and from 1.5 to 3 lbs. It results that Scotch boilers with water will weigh from say 37 to 50 lbs. per square foot of

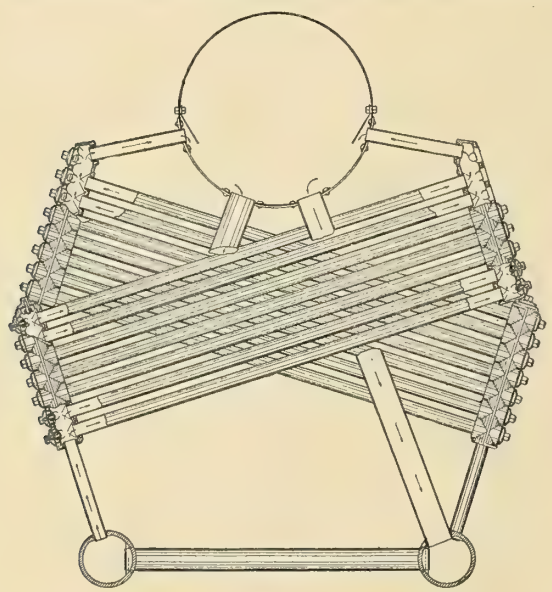


Fig. 11.

heating surface, while water tube boilers will similarly weigh from 13.5 to 23 lbs. These figures are not to be considered as giving absolute limits, but simply representative values for the lighter types. In a general comparison between water tube and Scotch boilers, the former have relative advantages in considerations relating to safety from disastrous explosion, weight, suitability for high pressures, quickness of raising steam, and ability to stand forcing. They have relative disadvantages in considerations relating to the more rigid restriction of the feed to fresh water, the necessity of greater regularity of feed, general sensitiveness to variation in the circumstances under which they are working, and to the general feeling of uncertainty as to their durability and efficiency under the conditions prevailing on deep water voyages.

Of materials for boilers, open hearth mild steel has displaced all rivals, and is used alone for shells, heads, combustion chambers and braces. Both steel and wrought iron are used for tubes. In the best practice, all longitudinal shell seams are *double-butt-strapped* and *treble-riveted*, while the circumferential seams are lapped and double or treble-riveted. Generally speaking, all flat surfaces in a boiler require special support by bracing. With cylindrical curved

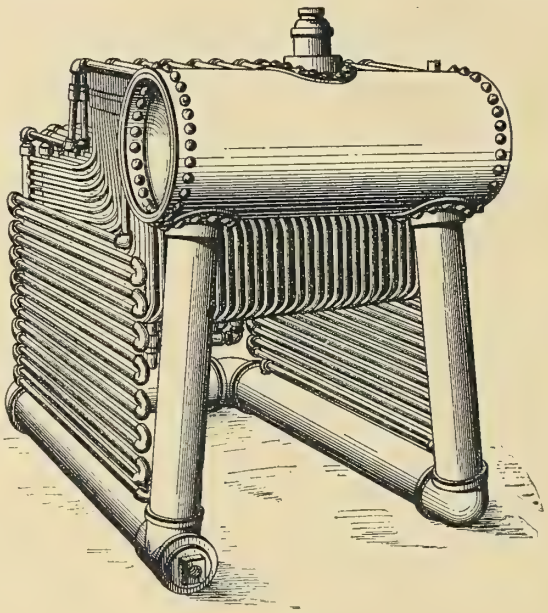


Fig. 10.

surfaces subjected to pressure on the concave side the stress is a direct tension, and may be provided for by a proper thickness of the plate. Cylindrical curved surfaces subject to pressure on the convex side are supported by stiffening bars or ribs running in a direction at right angles to the axis. Where flat plates are thick and not exposed to the direct action of the flame, as in the heads of Scotch boilers, the braces are usually spaced widely, from 12 in. to 15 in. between centers, and are relatively large. Where the plates are exposed to the flame and relatively thin, as in the combustion chambers, the braces are spaced more closely, usually about 7 in. between centers, and are relatively smaller in diameter. These latter being usually short and screwed into both plates, are called *screw stay bolts*. See Fig. 6.

**Boiler Casing**, *Covering* or *Lagging*.—A non-conducting covering placed around the boiler and intended to prevent the escape of heat by radiation. The material consists of some form of felt made non-combustible by special process, or, more commonly in modern practice, of some mineral material or fiber, such as magnesia covering, asbestos, or mineral wool. This covering is held in place by sheet-metal straps or bands, or in some cases by a complete sheet-metal casing.

## DURING THE MONTH.

The twin screw steamer Bulgaria, 12,000 tons, for the New York freight and passenger trade of the Hamburg-American Line, was launched at the yard of Blohm and Voss, in Hamburg.

The torpedo boat McKee was launched at the yard of the Columbian Iron Works, Baltimore. She is 101 ft. 6 in. long; 12 ft. 6 in. beam, and 4 ft. 3 in. draught. With 850 I. H. P. she is expected to reach a speed of 20 knots. Her armament will include two 18-in. Whitehead torpedo tubes and a rapid-fire gun.

In connection with the shipment of horses from America the Atlantic Transport Line is about to try an experiment at the London dock by establishing stables, which will accommodate about 200 head. Here animals which have crossed the Atlantic will be stabled for a rest before reshipment to points on the continent, or anywhere else which involves a long journey. There will also be an effort made to conduct sales of horses brought to England in connection with the stables.

The steam yacht Osceola, owned by Thomas L. Watt, of the American Yacht Club, was launched March 9 from Pine's shipyard, foot of Twenty-fourth street, South Brooklyn. The "Osceola" will be enrolled in the American and Atlantic Yacht Clubs. Her guaranteed speed is 15 miles an hour. She is built of wood, is 120 ft. over all; beam, 10 ft.; depth of hold, 18 ft.; 17 ft. 6 in. draught. She is schooner rigged. The interior trimmings are of white and quartered oak. The "Osceola" is expected to be in commission during the early part of April.

The new Maine Line steamer Horatio Hall was successfully launched at Roach's shipyard, in Chester, March 23. More than 3,000 persons witnessed the launch. The steamer was christened by Mrs. Jeannette Hall Clark, daughter of Captain Horatio Hall, the New York representative of the Maine Line, after whom the steamer was named. The new vessel has a double bottom, is 31 ft. long, 48 ft. beam, 20 ft. deep, and of 3,300 tons displacement. She is to have triple expansion engines and six boilers. She is expected to attain a speed of 18 knots. She will carry 2,000 tons of freight, have 135 staterooms, and be furnished throughout with electricity. Her cost will be about $400,000.

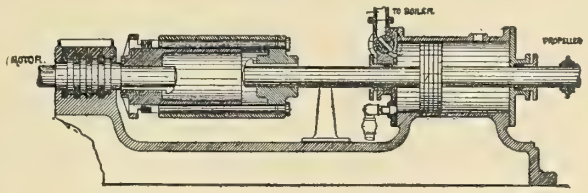
Officers Thomas G. Seagrave, George E. Beckwith and Hector R. Campbell, and twenty-four of the crew of the American Liner St. Louis, who participated in the gallant rescue of the passengers and crew of the Holland-America liner Veendam, on February 7, were presented with appropriate testimonials on March 14. Various officials of both lines, including Clement A. Griscom, president of the American Line, and General Agent of the Holland-America Line, were present. Each of the officers received a handsome silver cup and a medal, the latter from the Life Saving Benevolent Association. The men received substantial money prizes from both companies, and many expressions of recognition of their bravery were made.

The large steamer, the "Rapidan," for the American trade, was launched by Furness, Withy and Company, of West Hartlepool, England, to the order of the Chesapeake & Ohio Steamship Co. Her dimensions are: Length, over all, 490 ft.; beam, 56 ft.; depth molded, 35 ft. 6 in. She will be rigged as a four mast fore-and-aft schooner. The propelling machinery will consist of triple expansion engines, with cylinders 28 in., 46 in. and 75 in., by 54 in. and four single ended Scotch boilers, 15 ft. 6 in. dia. and 10 ft. 6 in. long, working at a pressure of 180 pounds. Accommodation for 800 head of cattle will be fitted. Her deadweight capacity will be 11,500 tons, and she will be engaged in the cargo and cattle service between London, Liverpool and Newport News, Va.

## SELECTED PATENTS.

*598,421.* MARINE SCREW PROPULSION. *Louis Hachenberg, New York, N. Y. Filed March 21, 1896.*

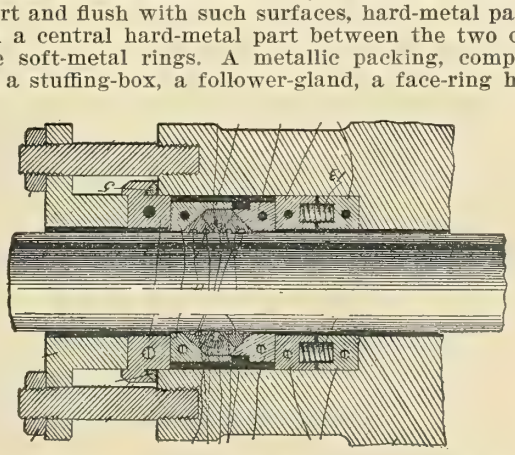
The combination with a motor-shaft, of a thrust-shaft, means intermediate of said shafts whereby they are slidably connected, a piston formed on the thrust-shaft, a cylinder in which the piston reciprocates, a supply for an elastic fluid under pressure to the cylinder, a valve for controlling the admission of fluid, and a cut-off mechanism operated by the thrust-shaft; all constructed to intermittently supply the elastic fluid to the cylinder, which fluid will main-




tain a constant equilibrium between the thrust and pressure by expansion or compression under varying conditions of thrust. The combination of a motor-shaft, a thrust-shaft, means intermediate of these shafts whereby they are slidably connected, a cylinder, a piston on the thrust-shaft adapted to reciprocate in the cylinder, a valve for admitting an elastic fluid under pressure to the forward end of the cylinder, and a cut-off operated by the thrust-shaft; there being an opening in the cylinder whereby an air-cushion may be established and a direct exhaust for the elastic fluid formed; all constructed to intermittently supply the elastic fluid to the cylinder, which fluid will maintain a constant equilibrium between the thrust and pressure by expansion or compression under varying conditions of thrust.

*598,123.* METALLIC PACKING. *Frederick F. Swain, Chicago, Ill. Filed August 9, 1897.*

In a metallic packing, the combination with a stuffing-box of wearing-rings mounted in such stuffing-box composed chiefly of soft metal, but having secured to their under surfaces, at suitable distances apart and flush with such surfaces, hard-metal parts, and a central hard-metal part between the two outside soft-metal rings. A metallic packing, comprising a stuffing-box, a follower-gland, a face-ring hav-



ing a shoulder supported by the follower-gland, wearing-rings having plane faces bearing upon the rod, inclined sides and a pyramidal recess, a pyramidally-shaped member bearing in such recess, reciprocating parts having inclined bearing-surfaces resting upon the rings and wearing-rings having sockets above the rod and a bearing at the inner end against the reciprocating part: whereby all of the members are supported by the rod and out of contact with the same, excepting the wearing-rings.

## TRADE PUBLICATIONS.

**A good deal of money** can be saved by care in handling oil, and a pamphlet issued by the Burt Mfg. Co., Akron, Ohio, gives a number of testimonials showing what a large amount of money can be saved by the use of the Cross filter, manufactured by this company.

**A neat catalogue** has been received from the Charles F. Elmes Engineering Works, Morgan and Fulton streets, Chicago, Ill. It contains eight large pictures giving views of this company's shop and a supplement illustrating and describing a direct connected electric plant made by this company.

**"Friction and Lubrication"** is the latest publication of the Joseph Dixon Crucible Co., Jersey City, N. J. It is an eight page pamphlet devoted to a careful and thorough consideration of the value of pure flake graphite for lubricating purposes. Every man who is interested in the subject of lubrication should send for a copy.

**A folder is received** from Cole & Kuhls, foot of Twenty-fourth street, Brooklyn, N. Y., regarding their elastic seam composition. This composition is designed for calking deck seams and checks and cracks in wood in any part of a boat. A number of testimonials and names of prominent yachts show that the composition is extensively used.

**Ship and yacht water-closets** of five types are finely illustrated and fully described in a large well-printed eight page catalogue issued by McCambridge & Co., Ltd., 525 Cherry street, Philadelphia, Pa. These closets are in use in many of the vessels in the United States Navy and some of the best-known coasting vessels and yachts in the country.

**Some very novel advertising** is being done by the W. S. Haines Co., 136 South Fourth street, Philadelphia, Pa., regarding the Heintz trap, one of the latest sheets comprising a card giving an amount of information regarding the Heintz trap, and having around the border pictures of all other kinds of traps. Heintz traps are sent on 30 days' trial when desired, as explained in these cards.

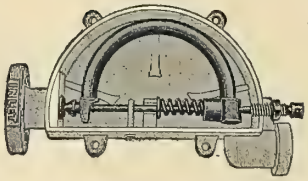
**An almanac** is a book that every boat finds convenient for reference, and the most complete one received this season is from the Woolsey Paint and Color Co., 100 Hudson street, Jersey City, N. J. It contains the usual information found in an almanac, with pictures and humorous matter, and a great deal of data written especially for use of marine people. Every reader will want to send to the company for a copy of the almanac, mentioning MARINE ENGINEERING.

**The 1898 catalogue**, issued by the Electric Gas Lighting Co., 195 Devonshire street, Boston, Mass., is a handsome one and should be in the hands of every one who uses primary batteries, electric gas lighters, etc. Several types of batteries are manufactured by this company, the best known one being the Sampson, which is very generally used for sparking purposes on gasoline launches, as well as for bell outfits and other uses where a powerful and long lived battery is needed.

**Two interesting and valuable catalogues** for engineers are published by William Craig, 42 Cortlandt street, New York. One relates to heating and circulating water and equalizing the temperature in steam boilers. A number of pictures illustrate the circulator and describe fully the work of this device. The other is devoted to valves and other specialties and contains more illustrations than the former and is more complete in many respects. In each catalogue are several testimonials showing the value of the device referred to.


# Hot Water

saved with the "Heintz" Steam Trap—puts it where you want it, too. Works in any position—opens and closes on difference of one degree of heat—211° to 212°—smallest size discharges one gallon water a minute and not an ounce of steam wasted. Six parts besides the case—No levers, no floats, no springs. Practically nothing to wear out. Ask for Booklet "G."



William S. Haines Company,
136 South Fourth Street,
Philadelphia.

*"The Heintz—the best—tho' it has imitators."*

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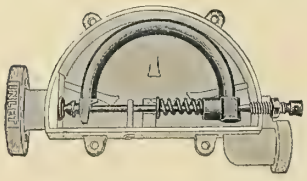
# An Extra Engineer

not needed to look after the "Heintz" Steam Trap. It's automatic, sensitive, lasts for years. Operates by expansion of sealed tube, which closes the valve as live steam enters the trap—212°: valve open at 211°. Smallest size discharges a gallon of water a minute.

Guaranteed to give best results and save coal and steam. Our Booklet "G." interesting to users. Ask for it.



William S. Haines Company,
136 South Fourth Street,
Philadelphia.

*"The Heintz—the best—tho' it has imitators."*

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# Graphite Lubrication

There is no substance known so smooth or so enduring as **Dixon's Pure Flake Graphite.** It is the best solid natural lubricant ever discovered. It is not affected by heat or cold, acids or alkalies. It is absolutely indispensable to every marine, stationary or locomotive engineer.

**It will pay you to send for Sample and Pamphlet. No charge.**

JOSEPH DIXON CRUCIBLE CO.,
JERSEY CITY, N. J.

REDUCING VALVES

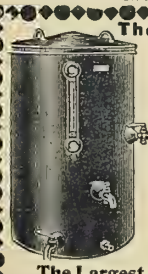
to control or reduce steam, water or air pressures.

"MASON"

Valves have had a world-wide reputation for years.

Catalogue Sent upon Application.

THE MASON REGULATOR CO.,
6 & 8 Oliver Street, BOSTON, MASS.



The CROSS OIL FILTER

actually reduces oil bills 50% or more. Sent on approval. Used in 17 countries. Adapted to steam vessels of every description. Send for circulars, testimonials, etc.

THE BURT MANUFACTURING CO.
AKRON, OHIO, U. S. A.
The Largest Manufacturers of Oil Filters in the World.


## BUSINESS NOTES.

A Good Order for Valves.—The Cleveland Shipbuilding Co. now has under construction one of the largest carriers on the Great Lakes for Pickands, Mather & Co., Cleveland, and among other fittings has ordered twenty-five reducing valves from the Mason Regulator Co., 6 Oliver street, Boston, Mass.

Increasing Facilities.—Arthur V. Denman, who for some years has had a shop at 232 West street, New York, for selling and repairing ship locks and hardware and doing all kinds of ship work, will remove on or before May 1 to much larger quarters with better facilities at 458 East Tenth street

Demand for Yacht Closets.—The Marine Appliance Co., 36 Oliver street, Boston, Mass., has been busier this season than ever before, especially in supplying closets for yachts. Circulars regarding the various types of closets made by this company have now been published and can be had by anybody interested in the subject.

A Fine Refrigerating Plant.—Colonel Oliver H. Payne, owner of the fine yacht illustrated in the February number of Marine Engineering, has ordered a Kilbourn ice machine of large capacity from the Kilbourn Construction Co., Drexel building, Philadelphia, Pa., for the new yacht. It will be one of the most complete refrigerating plants ever built for marine use.

Food for Sea-Going Vessels.—Concentrated foods are in much demand nowadays for use at sea, especially when packed so as not to be affected by dampness. One of the most recent products of this kind is the Standard Emergency Ration, hermetically sealed in tin; "always ready; never spoils," prepared by the American Compressed Food Co., Passaic, N. J. This is a high grade food and is particularly adapted for use on yachts, steam vessels, lifeboats and elsewhere.

Yukon River Boats.—Murray & Tregurtha, foot of F street, South Boston, Mass., have just completed a boat to be shipped overland for use on the Yukon River. It is 34 ft. by 9 1-2 ft., and has twin screws with a 4 1-2 by 5 engine on each shaft. The boiler is a Tregurtha water-tube, with 41 sq. ft. of grate surface. Tubular protections cover the propellers in order to avoid accidents as much as possible.

Moved to Larger Quarters.—The large increase in the business of the Eastwood Wire Mfg. Co., Belleville, N. J., has necessitated larger quarters for its New York office, and on or before May 1, the office will be removed from 121 Liberty street to 95-97 Liberty street. The company will then be better prepared to answer all inquiries regarding valves, whistles and other steam fittings, anti-friction metal, etc. The office is in charge of Franklin Williams.

A Busy Engine Builder.—James H. Paine & Son, Park and Clayton streets, Boston, Mass., have just finished a 10 in. by 20 in. by 24 in. compound engine for the yacht being built by Pryor & Clark, for a New Yorker, and have nearly completed work on a 6 in. by 9 in. by 15 in. by 9 in. engine for the yacht which Reed Bros., of Fall River, Mass., are building for D. M. Anthony, of the same city. These orders, with many others, have kept the shops of this company particularly busy this spring.

Propeller Stern Pipe Packing.—The Mabbs hydraulic rawhide packing, manufactured by the Mabbs Hydraulic Packing Co., P. O. Box, 829, Chicago, Ill., has met with much success on the Great Lakes and elsewhere for packing propeller stern tubes, and is now being used on the seacoast and elsewhere in the country. Many of the valuable features of this packing are told in a folder recently issued and which can be had upon application to the company, together with any other information desired.

A Sheriffs Steerer.—The tug just built by the Union Dry Dock Co., Buffalo, N. Y., one of the finest steel tugs ever constructed in the country, was fitted with a steering apparatus made by the Sheriffs Mfg. Co., Milwaukee, Wis.

Portable Elevators for Wharf Use.—A device of much value for handling barrels and other packages and properly tiering them is being put on the market by the Fox Portable Elevator and Rack Co., 120 Liberty street, New York. This device can be moved to any position, and by means of a crank the packages are hoisted to their proper position and put in place without delay and with the expenditure of a minimum amount of effort.

Reliable Planimeters.—In the working out of indicator cards the planimeter is a very necessary instrument, not only to save time, but to insure accuracy. In order to supply instruments that shall be thoroughly satisfactory in every respect the Keuffel & Esser Co., 127 Fulton street, New York, offer a variety. They are all equally efficient and differ only in degree of finish and fineness of graduation. The cheaper instruments are of high quality and are highly recommended to engineers who do not feel that they can pay a high price for an elaborately finished one.

Non-Magnetic Watches.—A non-magnetic watch is a timepiece that nearly every man who has anything to do with marine machinery will appreciate, particularly because of the very general use of electricity. In order to supply the demand for these and yet furnish a first-class timekeeper a company has applied the non-magnetic qualities to the celebrated "Paillard," one of the most famous Swiss movements, and is now offering them to the American market. Much information regarding these watches can be had in catalogues and circulars from L. R. Trickel, 18 John street, New York.

Holly Gravity Return System.—A device recently applied to steam vessels and now in use on steamers of the Hartford Line, the Clyde and other lines, is the Holly Gravity Return System. This device has no working parts and carries back to the boilers all condensation occurring in the steam pipes and elsewhere, and is designed to dispense with traps, pumps, etc. It works where there is any steam pressure and takes a very small amount of steam to keep it in motion. The rolling or pitching of a vessel does not check its working. Circulars and other information regarding this device are issued by the Holly Steam Engineering Co., Hartford, Conn.

An Increased Demand for Marine Paint.—The success met by Edward A. Bunker in introducing the Japan paints, advertised elsewhere in Marine Engineering, has necessitated his removal to larger and better quarters at 20 Broad street, New York. With his increased facilities he is now prepared to answer even more promptly than ever before all inquiries and give any other information desired. A new kind of paint which Mr. Bunker is putting on the market is called "Veluwe." This is a paint varnish of fine quality, unusual in its elasticity and brilliancy. It is particularly adapted to interior and exterior decorations on metal and wood work. Circulars have been issued regarding this paint.

Electrical Devices for use on Ship Board.—The Electro-Dynamic Co., 224 Chestnut street, Philadelphia, has devoted special attention to developing electrical devices for marine uses outside of the mere installation of marine lighting plants. One of these devices is a helm angle indicator. These are in use on several of the transatlantic liners, and have proved very efficient. Another device is an engine speed and direction indicator. This indicator is in use on board a dozen of the best known transatlantic liners and coasting vessels, also on several steam yachts and in the navy. Circulars regarding these devices can be had upon application to the company.


ALFRED B. SANDS & SON,

YACHT AND MARINE PLUMBERS,

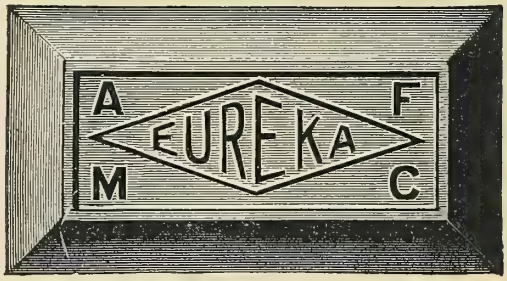
And Manufacturers of

PUMP WATER CLOSETS

For above or below Water Line. Suitable for Naval Vessels, Yachts, Torpedo Boats and Launches,

PUMPS, TANKS, Etc., Etc.

134 BEEKMAN ST., - - NEW YORK.




ANTI-FRICTION METAL.

Especially adapted for HEAVY AND HIGH SPEED ENGINE BEARINGS AND ALL KINDS OF MARINE WORK.
Outwears, runs cooler and with less lubrication than any babbitt or anti-friction metal made.
Descriptive Circular, Testimonials and Samples Free.
All Kinds of Superior Brass, Bronze, Copper and Non-corrosive White Metal Castings.

FENTON & CO., SELLING AGENTS,
39 Cortlandt St., New York.

LAMPS

For Every Purpose.

We make lamps for Yachts, Boats, Boathouses, Cabins, Wharves, Walks, or anywhere, indoors or out, where a good strong light is wanted.

Our goods need no recommendation from us. They are the standard. Other lamps are said to be "equal to," "like," or "as good as"

THE NEW ROCHESTER.

To be sure the lamps offered you possess the merits peculiar to the genuine, insist on seeing the name stamped in the metal. Catalogue free. We give as much attention to making special lamps, repairs, etc., as to our regular line.

THE ROCHESTER LAMP CO.

42 Park Place and 37 Barclay St., New York.

NEW PRICE LIST FOR PACKING.—A price list has just been published by the U. S. Metallic Packing Co., 427 North Thirteenth street, Philadelphia, Pa., of its various types of metallic packing. This list is one that every man connected with engines should have on file, because of the specific information contained therein.

SUCCESSFUL STEAM DEVICES.—The late Jacob G. Neafie, of the Neafie & Levy Ship Building Co., wrote to H. Bloomsburg & Co. regarding their steam "jets" as follows: "We have used many of them, and in all cases they have given entire satisfaction * * * In one instance we were requested to take out a boiler which failed to make the steam required, owing to its crowded condition. We used your jet and the parties were satisfied with the results." Regarding the Bloomsburg circulator, the engineer of the steamer Chester, of the Wilmington Steamboat Co., says: "Your circulator has given perfect satisfaction, even beyond our expectations. Our steaming capacity has increased wonderfully since their introduction. Before we put them in I could not hold steam, with feed water thrown overboard, long enough to take a set of indicator cards, but now I can hold all of the steam that the engine can use with throttle wide open, for hours at a time."

## SPECIAL NOTICES.

*Announcements under this heading will be inserted at the uniform rate of thirty-three-and-a-third cents a line. Lines average ten words each.*

**A KLONDYKE MINE RIGHT HERE.**

It is in the new patent Paragon Marine Boiler, illustrated and advertised elsewhere. Half interest or State rights for sale.
Address CAPT. M. DE PUY, 19 South St., New York.

**MANAGER WANTED.**

Wanted, a manager competent to design, direct and superintend the construction of boats and yachts. Should have a knowledge of steam and gasoline engines, and commercial experience is desirable. Address, stating experience and salary required, MANAGER, care MARINE ENGINEERING, World Building, New York.

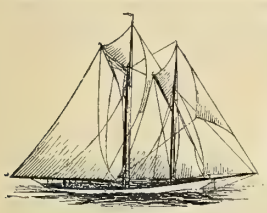
**OPEN FOR ENGAGEMENT.**

Naval engineer, graduate of United States Naval Academy, engineering course. Seven years' excellent practical experience. Excellent references. Speaks French and Spanish, some Danish.
Address S., MARINE ENGINEERING.

**PROFESSIONAL CARD.**

**H. B. ROELKER,**

CONSULTING AND CONSTRUCTING ENGINEER.
Manufacturer of **Screw Propellers** for Usual and for Special Work.
The Allen Dense Air Ice Machine for Steam Vessels.
41 MAIDEN LANE, NEW YORK.



**WHEN CALKING**
DECK SEAMS AND CHECKS IN RAILS, MASTS AND BOOMS,
**USE ELASTIC SEAM COMPOSITION.**
It is made in all colors and is positively guaranteed superior to any other seam preparation. It will not crack. When the wood expands it shrinks, and when the wood shrinks it expands. In use on steam yachts SOVEREIGN, CORONET, ALMY, RESTLESS, VENTURE, INTREPID, VALIANT, ELANOR, CLERMONT, BLACK PEARL, and many other yachts and other vessels.
**COLE & KUHLS, Foot of 24th St., BROOKLYN, N. Y.**

*MARINE ENGINEERS, ATTENTION!*

**THE AMERICAN SCHOOL OF CORRESPONDENCE**
(Chartered by the Commonwealth of Massachusetts.)
*Offers a SPECIAL COURSE in MARINE ENGINEERING.*

This course has been planned by the foremost marine experts of this country, and is thoroughly practical and scientific.

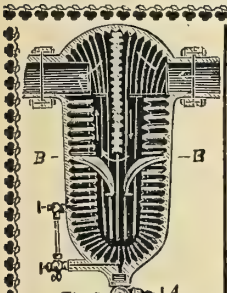
**We are SPECIALISTS, and teach ONLY**
**Engineering** { STEAM (*STATIONARY, MARINE, LOCOMOTIVE*) / ELECTRICAL / MECHANICAL

We do not **attempt** to teach anything and everything, but **do** teach the above courses thoroughly and well.
Our corps of trained instructors is selected from the best scientific schools of the country, and they devote their entire time to the students in the above important branches of mechanical science.
Thousands of enthusiastic students endorse and commend the progressive methods of our system of instruction.

**SPECIAL OFFER TO READERS OF MARINE ENGINEERING.**

33 1-3% DISCOUNT. For the next **30** days we will give readers of MARINE ENGINEERING a reduction of 33 1-3 per cent from our regular scholarship price (easy terms if desired). FOR 30 DAYS.
Your name on a postal card will bring you a handbook of the school, containing complete schedules of courses, pages from instruction papers, etc., etc.

**YOU CANNOT AFFORD TO MISS THIS OPPORTUNITY.**
**AMERICAN SCHOOL OF CORRESPONDENCE, 156 Tremont St., BOSTON, MASS.**




HINE ELIMINATOR separates WATER from live steam and extracts OIL from exhaust.

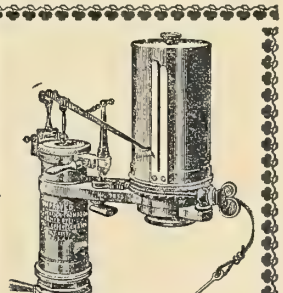
**SHE IS A BEAUTY.**

Her original is on full size pack of playing cards we are sending out for 2 labels (showing weights) cut from front of EUREKA PACKING boxes. All cards are special in 3 colors.

TRY EUREKA.

**DO YOU PAY**

Same attention to the ECONOMICAL running of YOUR engine as stationary plants? Most of them own INDICATORS and keep their valves in proper shape. It will pay YOU to send for circular. We are making special prices to introduce them on S. S. and yachts.



JAS. L. ROBERTSON & SONS, 218 FULTON ST., N. Y.